SCIENTIFIC AMERICAN

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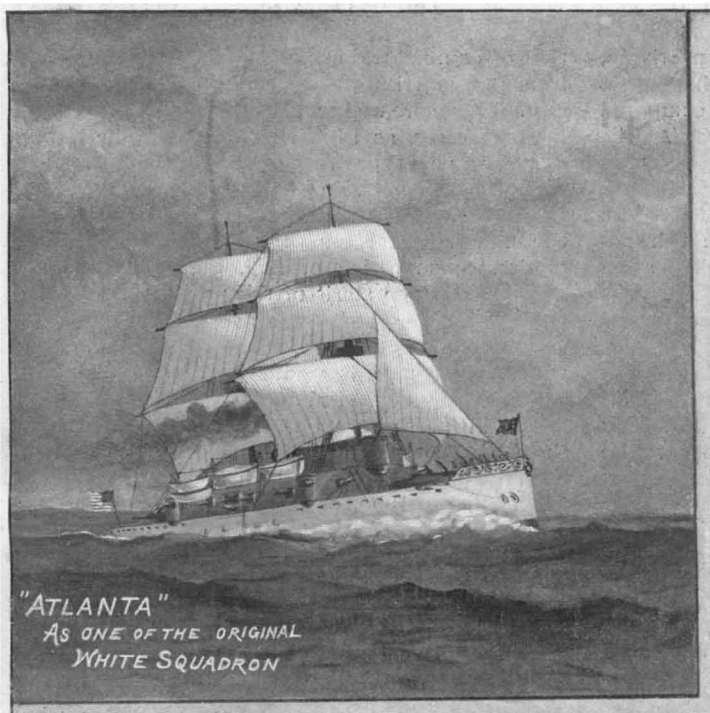

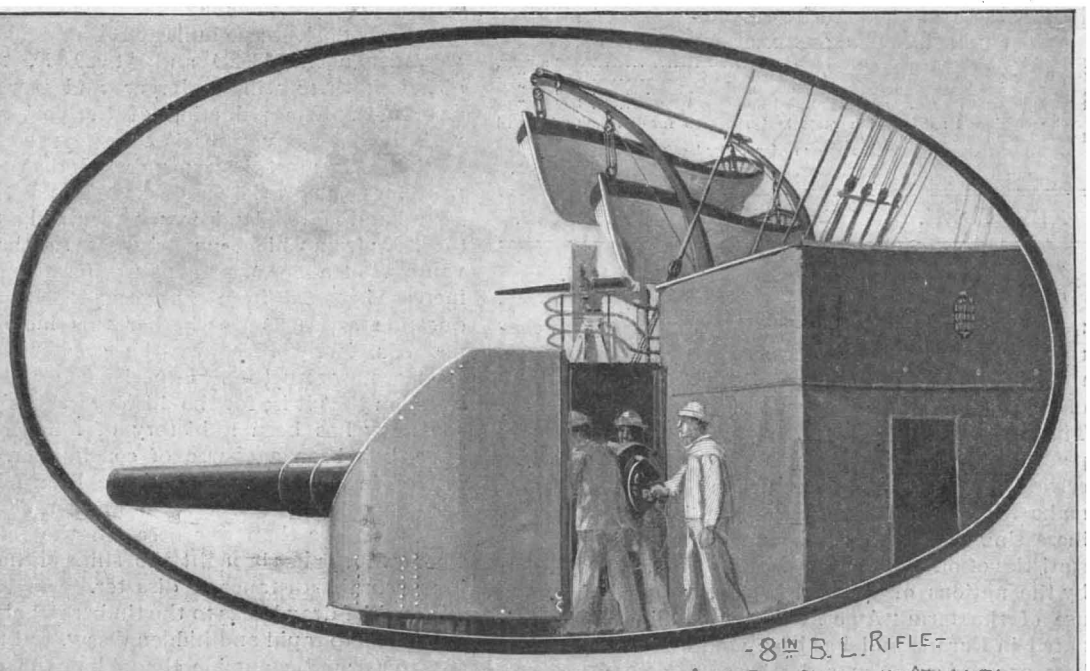

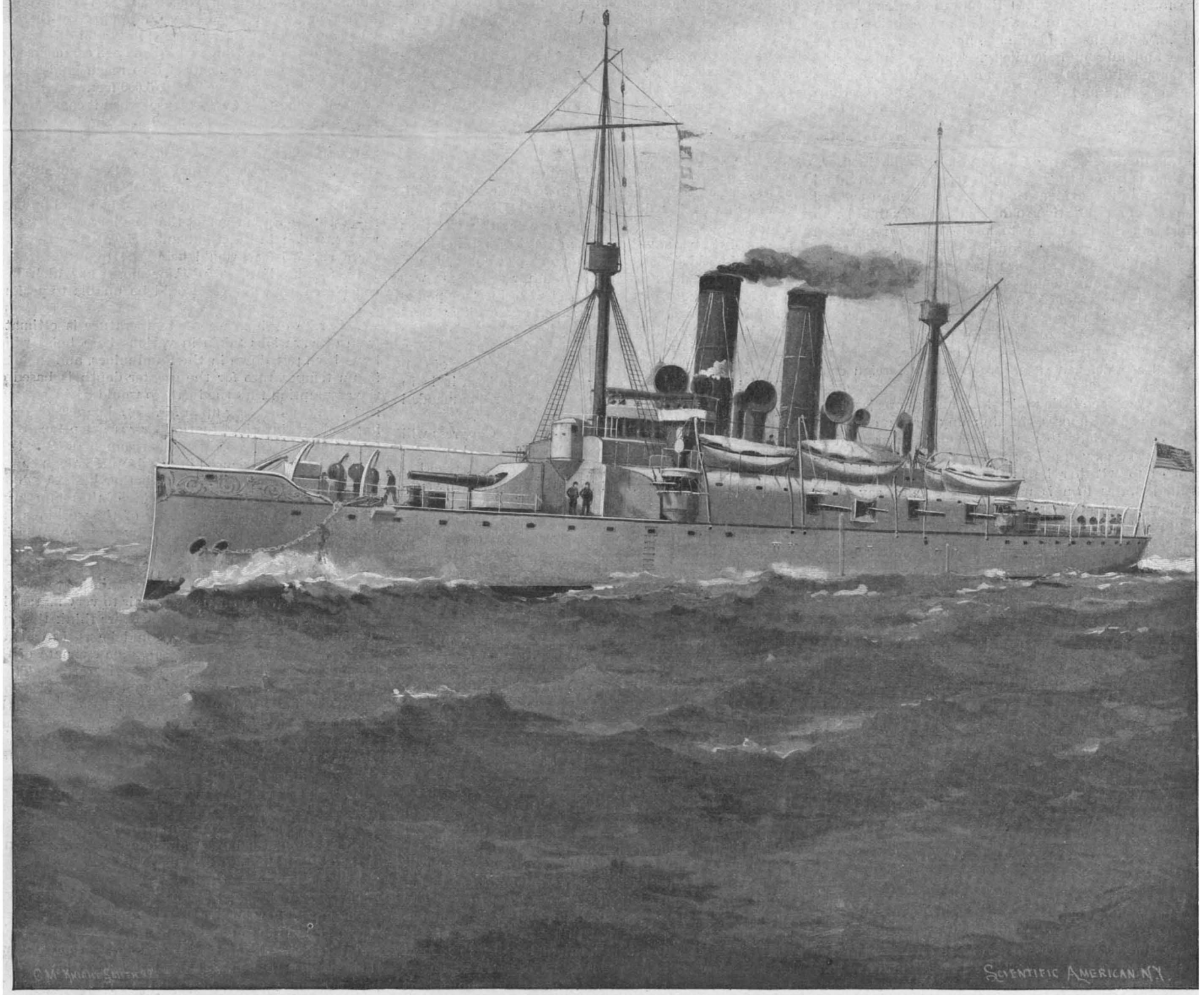

Displacement, 3,000 tons. **Speed** (estimated), 17·5 to 18 knots. **Maximum Coal Capacity,** 570 tons. **Complement,** 296. **Armor,** 1½-inch protective deck amidships for one-third of length. **Armament,** two 8-inch B. L. rifles, six 6-inch rapid-fire guns, one 3-inch field gun, six 6-pounder rapid-fire guns, four 1-pounder automatic guns, two Colt machine guns. **Date:** Launched, 1884; reconstructed, 1899.

THE RECONSTRUCTED CRUISER "ATLANTA."—[See page 424.]

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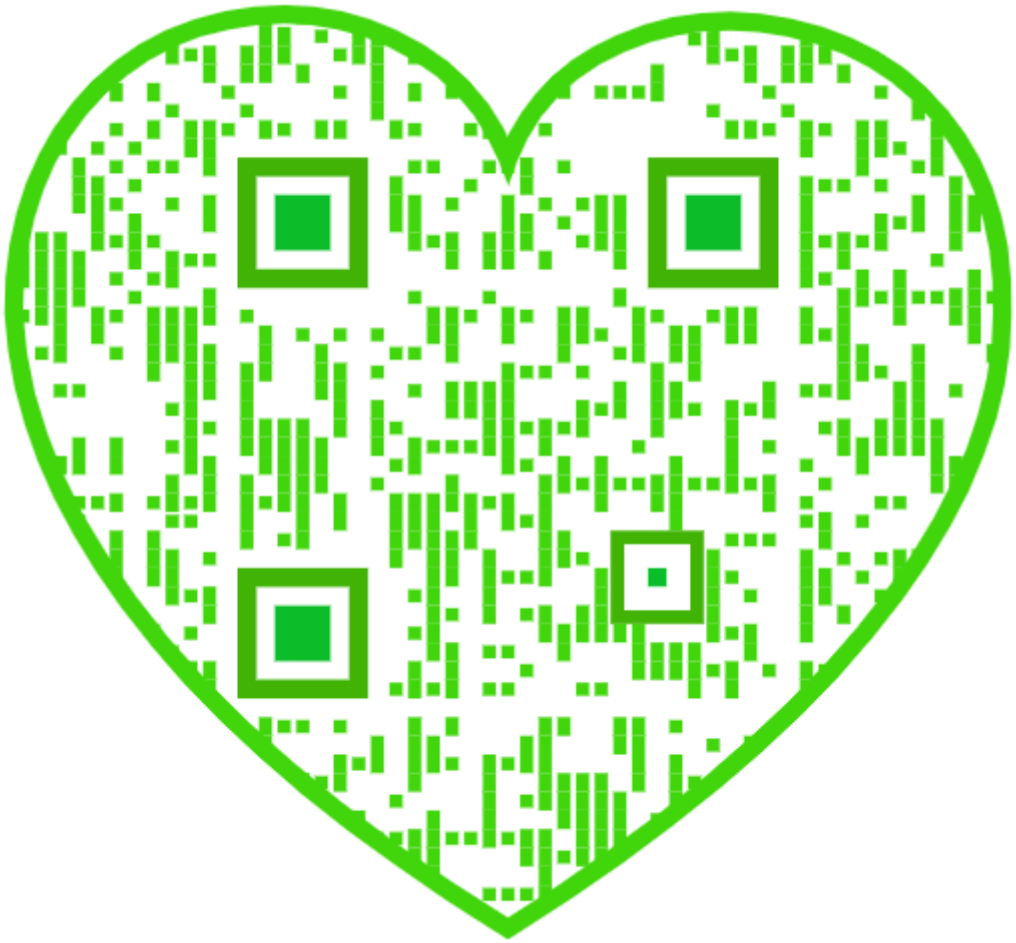

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OUR EXPORTS AND THE TRADEMARK.

The most significant and prophetic fact in the history of commerce at the close of the nineteenth century is the phenomenal increase of the export trade of the United States. Measured by the rate of growth of the exports of other countries, it has no parallel. Time was (and that but a few years ago) when we depended almost entirely upon European factories for certain lines of merchandise, which to-day we not only make for ourselves, but sell abroad in large and ever-increasing quantities. It is unnecessary to repeat the statistics of our success; its reality, and its recognition by the nations of the Old World, are proved by the use of the term "American invasion," which originated in Europe and has been voluntarily accepted as best expressing, from a foreign point of view, the gravity of the commercial situation.

Although the success of this "invasion" is due primarily to the low cost of our manufactures, and this, in turn, to improved machinery and methods, our goods are forcing their way into European markets largely an account of certain national characteristics in the way of convenience, handiness, lightness, neat appearance and all-round simplicity. These characteristics are summed up in the European mind under the term "American;" and the purchaser over there has come to recognize the fact that whether the subject of his purchase be a carpet-sweeper or a machine-tool, the fact that it is "American" guarantees its possession of certain qualities that are dear to the heart of the user.

What is true of the national is true of the individual export, and it is evident that if we are to reap the full benefits of a reputation so distinctive and valuable, an effort should be made to protect this reputation against every form of fraudulent imitation. That the successful inroads of American trade will lead to strenuous efforts at imitation goes without saying, and unless our commercial houses make haste to protect their goods by registering trademarks in those countries in which they are establishing a market, they will find that these very trademarks have been already appropriated as a defensive measure by their foreign competitors.

It is a fact, too little understood and appreciated by our commercial houses, that in many foreign countries the exclusive right to use a trademark is granted to anyone who may apply for it, irrespective of the question as to whether he is the first user. Thus, if a United States firm is making large sales, say of an Anchor brand of flour, in Germany, there is nothing to prevent a German citizen from registering that very trademark for flour, and using it on his own barrels, to the exclusion of the actual American product under that particular mark.

In urging our manufacturers to secure trademark protection at a time when they are so successfully establishing themselves abroad, we would speak a word of caution against the practice of registering trademarks in the name of a foreign agent. While this is done to simplify matters in bringing suit against infringers, it is liable to place the manufacturer in a difficult position in case of disagreement with the agent, who, holding the trademark in his own name, is legally entitled to the use of it should he be disposed to open in business on his own account. Although this is an extreme case, and probably would not often occur, we mention it as one among several reasons which render it advisable for a manufacturer to secure the important trademark privileges in his own name.

MASONRY AND TIMBER DRY DOCKS.

If we are quick to learn the lessons of the past, there will be no more timber dry docks built in this country, at least for the uses of the navy. Between a masonry and a timber structure the advantages urged in favor of the latter are, or rather have been, rapidity of construction and small first cost. To these considerations alone is due the fact that so many of these objectionable structures are to be found in our navy yards. The objections to the timber dry dock are many and serious, and do not diminish with the lapse of time. On the other hand, the advantages are by no means so great to-day as they were forty or fifty years ago. Up to a recent date it has been customary for the advocates of timber structures to quote the cost of the stone docks at Mare Island and New York, in contrast with the relatively low cost of timber docks. Those two docks cost respectively $2,000,000 and $2,750,000, whereas timber docks have been built for about $600,000. As a matter of fact, however, the New York and Mare Island docks were built by the government by day labor, and we all know that work of this kind has never been conspicuous for its economy. The contracts for the two new stone docks to be built at Boston and Portsmouth were let at $1,013,400 and $1,089,000, respectively, although these will be larger and more important structures. The reduction of the cost as compared with the older structures is over 50 per cent. At the same time it must be remembered that the contract price for two new timber docks to be built at League Island and Mare Island was respectively $729,000 and $782,600; from which comparison we see that all the advantages of a masonry structure may be gained at an increase in cost of from 25 per cent to 30 per cent. The question arises as to whether this increased cost is not completely offset by the greater durability of the masonry structure. Experience proves beyond all question that it is; for the history of timber docks in the navy has been a history of failure. Not only have they been a source of constant anxiety to the officials in charge, but they have been frightfully extravagant in the cost of repairs and renewals. Moreover, on more than one occasion the failure of the wooden docks has brought the ships of the navy within measurable distance of disaster.

The chief drawbacks to the timber structure are that it is liable to rapid and hidden decay, and that seepage of water from the outside channel, or the existence of concealed springs at the back of the dock, may at any time wreck it by bursting in the sides. A notable instance of this was the failure of the two timber dry docks at the New York navy yard, Brooklyn. The big dock, known as No. 3, commenced to leak immediately after it was completed, and repairs were necessitated which lasted for eighteen months and involved an expenditure of $170,000. The timber dry dock No. 2 of the same navy yard was wrecked during a heavy rain storm in July last, when the hydrostatic pressure due to accumulation of water behind the altars was sufficient to burst in the side of dock. In this case a structure which originally cost $500,000 has so completely failed within nine years of the date of completion as to necessitate the expenditure of 60 per cent of its first cost to put it again in a serviceable condition. The timber dock completed at League Island, Philadelphia, in 1891, is already so far decayed that shores of timber have had to be placed at certain points which showed signs of weakness, to prevent collapse, and when the dock was uncovered for repairs, it was found that the tops of the piles were in some places entirely rotted away. The timber dry dock at Port Royal station, which was finished just before the Spanish war, is reported by Admiral Endicott as having experienced a series of accidents in the way of failure of portions of the structure, and, indeed, it is in such a perilous condition that $500,000 is recommended by the Admiral for its immediate rebuilding.

In view of these facts we trust that Congress will disregard the solicitations of the interested parties who may desire to see timber dry dock construction continued in the navy, and that they will heartily support the recommendation of Admiral Endicott, the Chief of the Bureau of Yards and Docks, that stone be substituted for timber in constructing the two docks which are about to be started at the League Island and Mare Island yards. The subsequent repairs to timber docks, as we have seen, bring the ultimate cost far beyond that of a reliable and durable stone structure, and on the question of facility of erection it is enough to say that the contractors for the new masonry docks at League Island and Mare Island undertake to build them in the same time that is allowed for the construction of the two timber docks at those yards.

REMARKABLE FRENCH RAILWAY EXPRESS SERVICE.

In the last issue of the SCIENTIFIC AMERICAN we gave a somewhat elaborate comparison of the great railway systems of the world, based on the length of the track and the magnitude of the equipment and freight and passenger traffic. In this comparison we took no account of speed, which, of course, as a modifying factor should exert a powerful influence in determining the question of relative excellence. The French railroad system, which in point of size and importance ranks about fourth among those of the world, stands easily at the head of the list in respect of the number and speed of its express passenger trains. A recent tabulation of these trains shows that Le Chemin de Fer du Nord operates no less than forty-five trains a day with an average running speed, including stops, of from fifty to sixty miles an hour. Of these, eleven have a speed of fifty miles an hour, nine of about fifty-one miles an hour, eleven about fifty-two miles an hour, three of about fifty-three miles an hour, ten of from fifty-four to fifty-seven miles an hour, and one train has a timed running speed of sixty and a half miles an hour. It will be evident to anyone who is acquainted with the subject of high speed travel that these are extraordinary results; and while this country and Great Britain have a few trains of from fifty to fifty-four miles an hour speed, and the United States runs two summer trains at rate of about sixty miles an hour, such speeds are not characteristic of the whole of the express service. Mr. Charles Rous-Marten, who is the best known expert abroad on the question of express trains and their performance, states from personal knowledge that the trains are not by any means mere racing outfits, but weigh from 150 to, in some cases, as high as 300 tons. The hauling is done by a new type of four-cylinder compound engine, designed by Messrs. De Glehn and Bousquet. We hope to illustrate these engines at an early date, and at the same time give some further data concerning the grades, consumption of fuel, and other particulars showing the true merit of the performance. As compared with the speed of the average express trains of this country, these results are certainly a great advance. Of course, it would be possible for us to run trains at the same speed and in the same number, but it would necessitate one of two things—either we should have to build engines of even greater power than the powerful types which we have at work (which is scarcely possible), or else it would be necessary to split the trains in two, using two engines where we now use one, which is practically the method adopted on the Continental roads.

THE POSSIBILITIES OF DEEP MINING IN THE TRANSVAAL.

In a paper recently read before the South African Association of Engineers by Mr. John Yates, who has been for many years identified as an engineer with mining on the Rand, the possibilities were discussed of mining of much deeper levels than any that have been hitherto reached. It seems that at present there are what are known as the outcrop mines and the first and second deep levels, while work has been commenced on other shafts which are expected to reach gold-bearing veins at a depth of from 4,000 to 5,000 feet. Mr. Yates is of the opinion that in the future, when it comes to mining at lower depths than 5,000 feet, the best method would be to run from the lowest existing levels down to the underlying reefs by means of inclines, rather than by sinking vertical shafts. It is assumed by the writer that the limit of depth at which mining operations can be carried on will be 12,000 feet, and he bases this estimate upon the fact that the increase of temperature, which in the Rand mines is at the rate of 1° for every 205 feet, would bring the temperature at a 12,000-foot level up to 100° F. or more; at which it is considered that miners would be unable to perform effective work.

This rate of increase of temperature is estimated from observations taken in various bore holes which have been put down in the Rand mines, and the maximum temperature for the greater depth is based on the assumption that the increase would be in a steady ratio. In commenting upon Mr. Yates' paper, The Mining and Engineering Journal draws attention to the fact that this rate of increase is much greater than that which is experienced in our deep Michigan copper mines, and raises the question whether sufficient allowance has been made for the lowering of the temperature which would follow the opening of the workings and would undoubtedly be produced by proper ventilation of the lower levels. We think that the exception is certainly well taken, for it would be possible with our modern improved machinery for ventilation to carry to these lower levels sufficient cool air to very materially modify their temperature, although we think the suggestion offered that liquid air could be used to advantage is based upon an over-sanguine estimate of the practical value of this means of refrigeration. There is a general consensus of opinion among geologists and mining engineers as to the extent and richness of the "banket" beds of the Witwatersrand, and unless they are mistaken, the opening up of the lower beds, even at depths of from 12,000 to 15,000 feet, would be a profitable undertaking in spite of the enormous amount of capital that would be sunk in reaching them. It is estimated, however, that these lower workings must be richer than they have yet proved to be, if they are to justify the enormous amount of capital which would be involved in sinking to such great depths.

RECOVERY OF SUBMERGED LAND IN HOLLAND.

The unconquerable persistence of the Dutch race is very much in the public eye just now. Alike in peace and war the inhabitants of the Netherlands have shown their ability to pursue a project with that tireless patience which, other things being equal, is certain to bring success. The struggle between the people of the Netherlands and the encroachments of the waters of the Zuyder Zee is a thrilling story, and the fight evidently

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is not over yet. The land that has been recovered has been held, and now a further and determined effort is being made to recover the submerged territory, which hundreds of years ago was included within the coast line of the Netherlands. The present attempt does not contemplate the recovery of the whole of the Zuyder Zee, but if the plans do not miscarry, it is certain that nearly 800 square miles of land will be reclaimed within the next third of a century at an estimated expenditure of $48,000,000.

The scheme contemplates the construction of a huge dike across the Zuyder Zee, the location of which will be determined by the favorable conjunction of shallow water and adjacent islands. Nine years out of the thirty-three which is the estimated time for the construction of the whole scheme will be occupied merely in the construction of this dike, whose total estimated cost will be $17,000,000. When the dike is completed, the herculean task of pumping dry the huge lake thus formed will commence, and considerations of economy will lead to its being carried on by means of the typical Dutch windmills which form such a picturesque feature of a Holland landscape. Although the work of drainage is to extend over a quarter of a century, the returns on the enormous expenditure of the capital will commence simultaneously with the pumping, and as it is estimated that the drained land, on account of its extreme richness, will have a market price of $300 an acre, it can be seen that this great undertaking is likely to become a paying investment long before it is finally completed.

AMERICAN APPLES AT HOME AND ABROAD.

Since the West and Northwest entered extensively into apple-growing, the so-called "off years" in this crop no longer affect the markets as they did fifteen and twenty years ago. One season of great scarcity then, with extremely high prices, would often be followed by a year of superabundance, when the markets would be glutted with apples, which were difficult to dispose of at any price. The thousands of acres of apple orchards in the great West prevent an old-fashioned famine in apples, and the improved methods of exporting the fruit, and the numerous factories which make cheap jellies and preserves, tend to distribute the abundant crops so well that unprofitable prices do not rule in the markets in good seasons.

The present harvesting season of the apples is now in progress, and the official reports indicate an "off-season," which ten years ago would mean an apple scarcity this winter that would make the fruit an expensive article of diet. But prices will advance only a trifle over those of last season. The factories will consume fewer marketable apples, and depend more upon the apple waste, such as cores and peelings, for their supply. These jelly factories in good seasons buy apples on the trees, but in years like the present they can make their apple sirup-jelly from the waste of the canning factories. There are some 130 factories in the country engaged in canning this fruit and making cheap jellies and sirups. In the aggregate they have an annual capacity of over 200,000,000 jars of jelly alone. The jellies made from the apple waste are almost as good and wholesome as those manufactured from the whole apples. The cores and peelings, and small, inferior apples are ground up and the juice extracted from them. This juice or sirup becomes the foundation of the cheap jellies, and not chemical compounds as some suppose.

The West has become such an important factor in the apple problem that it is estimated that these comparatively new orchards could supply all the apparent needs of the markets if half the trees in the country failed to produce anything. At first the sudden flood of this fruit from Kansas, Missouri, Nebraska, Michigan, and other Western States completely demoralized the Eastern markets, reaching a climax in 1896, when apples in New England were offered on the trees at 15 cents a barrel and hand-picked Baldwins delivered on the cars at 40 cents a barrel. The orchards in the West were planted in 30, 50, and 100 acres, and in order to prevent growers from going into bankruptcy a great flood of the apples was rushed to Europe. The exports of our apples have consequently grown to phenomenal proportions, and without this demand the crop would prove a financial failure every season.

Liverpool is by far the greatest distributing point for American apples, and as high as 100,000 barrels of our apples have been sold there in one week, and at remunerative prices. London, Glasgow and Hull also receive immense cargoes of American apples, and absorb on an average from 20,000 to 30,000 barrels a week during the season. The apples are sold in Liverpool by the auction system. A large room is provided for the buyers and the auctioneer. In the center of this room there is a portable platform or a freight elevator, where samples of the lots to be disposed of are exhibited. An auctioneer who has a line to dispose of has forty minutes at his disposal, and if his goods are not all sold in that time he must temporarily stand aside to make room for another salesman. Monday, Wednesday, and Friday are the auction days, and a single auctioneer may dispose of 10,000 to 15,000 barrels in a day. The apples are catalogued, and those brands which have a reputation for honesty and good packing frequently sell without sampling. One barrel from every lot of twenty is opened on the portable platform and the contents dumped into baskets, and another barrel is simply opened on the face end From an examination of these two samples the buyer judges the lot of twenty, and makes his purchase accordingly. Only tight barrels are delivered to him; "slack" barrels, where the apples rattle, are rejected. These latter sell separately, and usually from 50 to 75 cents a barrel less. When a purchaser's bid is accepted he can take his twenty barrels, or as many more of the same brand as he desires, at the same price. The apples are delivered to the purchaser direct from the steamer's dock, which saves the cost of double cartage.

Ocean rates for apples of course vary, but they usually run from 40 to 65 cents per barrel. The charges in Liverpool for dockage, insurance, advertising, sampling, town dues, and for labor of handling, amount to about seven pence English money, and the auctioneer's commission for selling is 5 per cent. The cost of getting the apples to the steamer on this side varies likewise according to the distance they have to be shipped. Picking apples in the East costs from 12 to 20 cents per barrel, according to the skill of the pickers and the amount of apples to handle. Special pickers have in recent years entered the field to contract for whole orchards, and they do the work so much better that the loss to the farmer is greatly reduced. Carelessly picked and packed apples usually yield little profit to the producers. New apple barrels cost about 17 cents, which must be added to the cost of harvesting; and sorting, heading and getting to railroad shipping points, about 8 cents more. Thus a barrel of apples costs the farmer from 40 to 46 cents before the transportation charges to the city are made. These latter cannot be estimated, on account of the differences in the distance from the markets. The cost of delivering a barrel of apples from a town in Kansas to New York is very much higher than the Hudson River growers have to pay when they send their fruit down by boat.

Our yellow Newtown or Newtown Pippin is probably the greatest favorite in England, and it often sells for two or three times as much as any other apple. This variety was introduced in London by Benjamin Franklin in 1758, and has been a prime favorite ever since. Next to this the red varieties are chiefly in demand. The Baldwin is a good apple for export, for its high color pleases the English, and it has good shipping qualities. More apples of the Ben Davis variety are grown to-day than any other, because in the West it does better than almost any other type of this fruit. It is a good keeper and shipper, and sells faily well abroad. In the East this variety does not do as well as in the West. The Rhode Island Greening, Northern Spy, and Winesap are other great favorites at home and abroad, and they are raised in large quantities in this country and Canada. G. E. W.

THE TRUE INVENTOR OF THE TELEGRAPH.

BY HEILEMAN WILSON.

At the close of this century, when the seeming perfection of the wireless telegraph excites the wonder and admiration of the world, it is interesting to look back and note the first steps toward telegraphy, and also to learn of the first true inventor of the electric telegraph. In rude forms, even among the most savage nations, there has always existed some system of communicating intelligence by signals, which during the daylight might be of almost any type, though at night luminous ones of necessity had to be used; but neither of these signals was visible in fogs, and so for days there could be no communication at all. This interruption happened most notably at the time of the battle of Waterloo, in consequence of a fog coming on during the transmission of a message from the seat of war to the admiral commanding at Plymouth. The words which reached the admiral were: "Wellington defeated;" this much of the message reached the admiral in the morning, and was the cause of great anxiety until a clear afternoon revealed the cheering words, "the enemy."

The electric telegraph, like everything else of permanent value, has been a growth, and the first step toward it was made something over a hundred and fifty years ago, in both France and England, when an electric shock was made to successfully pass through an iron wire a distance of six thousand feet in less than a quarter of a second; this was the French experiment. In England it was attempted on an even greater scale, for not only was the electric current transmitted a distance of two miles, but it was proved beyond the possibility of doubt that electricity passed instantaneously. The philosophers who made the discovery seem to have been satisfied with the result attained, for they attempted no application of the valuable fact, and it was reserved for a Scotchman living at Renfrew to suggest that messages might be sent by electricity along wires passing from one place to another. This—as it was then considered—remarkable idea was submitted in the form of an article to The Scots Magazine, Glasgow, 1753. The article bore the initials "C. M.," and this is the only name we shall ever have for the first inventor of the electric telegraph.

The plan of "C. M." was to have a set of wires, equal in number to the letters of the alphabet, stretched horizontally and parallel between two given points, and each of them about an inch from the one next to it. At the end of every twenty yards the wires were to be fixed on glass to some firm body to prevent them from touching the earth and also from breaking by their own weight. The battery—or the electric gun barrel as it was then called—was to be placed at right angles with the ends of the wires and about an inch below them. It was now necessary to contrive some scheme for forwarding messages, and for this purpose the plan of "C. M." was to suspend a ball from every wire, and about the sixth of an inch below the balls were to be placed bits of paper, each in its order bearing a letter of the alphabet. These bits of paper, or some other light substance that would be easily attracted, were to rise to the electric balls, and were so contrived as to resume their proper place when dropped.

All this being done, "C. M." proposed to converse with his distant friend in this manner: Having set the electrical machine going, let it be supposed he wished to open the conversation with the word *when;* then with a piece of glass or some other non-conducting substance, he would strike the wire, *W*, so as to bring it into contact with the battery, then strike the remaining letters of the word in the same way; almost instantly the correspondent at the other end of the line would observe the several letters rise in order to the electrified balls at his end of the wires; as each letter rose, it was to be written down on a piece of paper. But in the event this method should prove tiresome, "C. M." suggested that instead of the balls, a set of bells equal in number to the characters of the alphabet and decreasing in size from the bell, *A*, to the bell, *Z*, might be suspended from the roof, and from the horizontal wires there was to be another set of wires reaching to the several bells. Then the man who began the conversation was to bring the wire in contact with the battery, and the electrical spark, working on bells of different size, would inform the correspondent by the sound what bells, or wires, had been touched. Of course, to understand the language of these chimes, without writing down each letter, required some practice.

In all his plans it was evident that "C. M." had not heard of the experiments and discoveries in the transmission of electricity in England, for he seemed to fear that the force of the electric current would diminish, as, so far as he appears to have known, it had never passed further than thirty or forty yards, or at all events it might be drained off by the surrounding air. To prevent this last interference he invented a scheme of insulation, which was simply to cover each wire with jeweler's cement.

Here then we have an electric telegraph nearly a hundred and fifty years old, and although exceedingly crude when compared with the many improvements of the present day, yet, since it could swiftly and accurately convey intelligence, it must be admitted that "C. M." was the true inventor of the electric telegraph, and that every step made since that time, however wise and valuable, can be viewed in no other light than an improvement on the idea of an unknown man. It is singular that the ingenious inventor should not have found some way of diminishing the number of wires; but he does not seem to have had any idea that his invention would be adopted, and so he probably contented himself with a general view of the principle.

VOLTA'S VISIT TO PARIS.

M. Mascart, who was one of the delegates sent by France to the Volta Centenary at Como, delivered an address on that occasion which is of interest as recording the visit made to Paris by Volta in the early part of the century. The proceedings of the Academie des Sciences for the year 1802 show that Volta repeated his experiments before the physical section of that body and was awarded a gold medal in consequence. It was after these experiments, which naturally excited great interest among the scientists of the time, that the Academy, upon the suggestion of Napoleon, founded an annual prize of 3,000 francs to be awarded for electrical researches. Besides this, Napoleon, at that time First Consul, had the sum of 6,000 francs awarded to the savant. Some time after, he wrote from Italy to the Minister of the Interior, saying, "I wish to make an award of 60,000 francs to any person who by his experiments or discoveries will make a step in the electrical science comparable to those made by Franklin and Volta." Subsequent history shows that the Academy prize of 3,000 francs was awarded to Sir Humphry Davy, Gay-Lussac and two others. The prize founded by Napoleon was not given under the first empire. Napoleon III. re-established it, and the republic continued the tradition. Under the name of the Volta prize it was awarded to Ruhmkorff, Graham Bell and Gramme.

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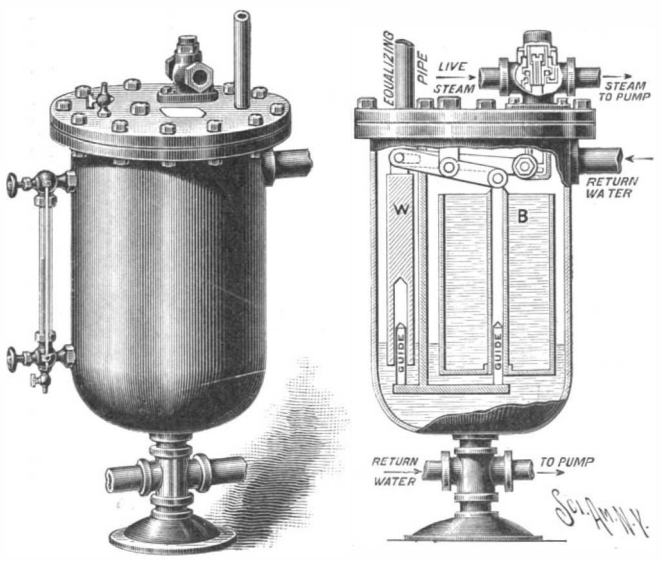
AN AUTOMATIC PUMP GOVERNOR AND RECEIVER.

In the steam-heating system of a building an automatic device should be provided, which receives the water of condensation from the radiator coils and pipes, controls the pumps, obviates the objectionable "hammering" of the pipes, and returns the water of condensation to the boiler while still hot. A device of this nature is made by the Creamer Steam Specialties Company, Jansen Hasbrouck, proprietor, of 126 Liberty Street, Manhattan, New York city.

The apparatus, as our sectional view indicates, comprises a receptacle (into which all water from coils, etc., drains) containing an open metal bucket, *B*, and a weight, *W*, twenty times heavier than the bucket, both hung from the ends of a lever fulcrumed at its middle. A second lever is fulcrumed at the weight end of the first lever and is connected with the vertical stem of the steam valve. As the water of condensation flows into the receptacle and into the bucket through the return pipes, the weight descends, pulling down the corresponding end of the lever, thereby opening the steam valve and automatically starting the pump. When the water within the receptacle has been pumped out, the distribution of weight is reversed, the filled bucket now being twenty times heavier than the weight; hence, the weight is raised, the steam valve closed, and the pump stopped. As the water again accumulates in the receptacle the bucket is buoyed up, and the operation begins anew.

The apparatus is now in use in many large office buildings and institutions, in connection with pumps of all kinds. In old and new buildings it will completely obviate all those objectionable noises in steam pipes which are occasioned by the collection of the water of condensation. The returning of this water of condensation in its heated condition to the boiler is another of the advantages incident to the use of the device.



AN AUTOMATIC PUMP GOVERNOR AND RECEIVER.

QUICKSILVER FOUNTAIN AT EARL'S COURT, LONDON.

Mr. Charles Bright, F.R.S.E., the well-known English electrical engineer, has recently devised a complete novelty in fountains for the Queensland government's show at the Earl's Court Exhibition, in which it now forms the main center of attraction. Its *raison d'être* comes about owing to Queensland being anxious to attract attention to mercury as an important product of that country, and here Mr. Bright, judging from the crowd which daily gathers round the fountain, seems to have given them an apparatus more likely than any to produce this effect. When it is remembered that mercury has a weight nearly fourteen times that of water, it will be seen that the problem was no easy one. In order to describe this invention in anything like detail we must first refer our readers to the accompanying drawing.

The mercury falls from an upper bowl about 4 feet in diameter to one some 7 feet below, and about 7½ feet in diameter. This entire device is coated with black paint to show off the silver. The price of mercury runs at about 2/6 per pound as often as not—and, as we know, a pound of mercury does not go very far in bulk; thus one of the main considerations in view was to employ as small a quantity as possible, and anything like an imposing Niagara Falls of the liquid metal was soon ruled out of court. Thus, the upper basin is filled up with cement by way of converting it into a flat table with some sixty-four grooved channels at 2-inch intervals round the lip to conduct the quicksilver in modest quantities over the edge.

Similarly things are so regulated that there is just enough mercury in the lower bowl to float a number of household flatirons and chunks of rock; and it is here that the man in the street is impressed with the fact that it is mercury and not water that is sent through the fountain.

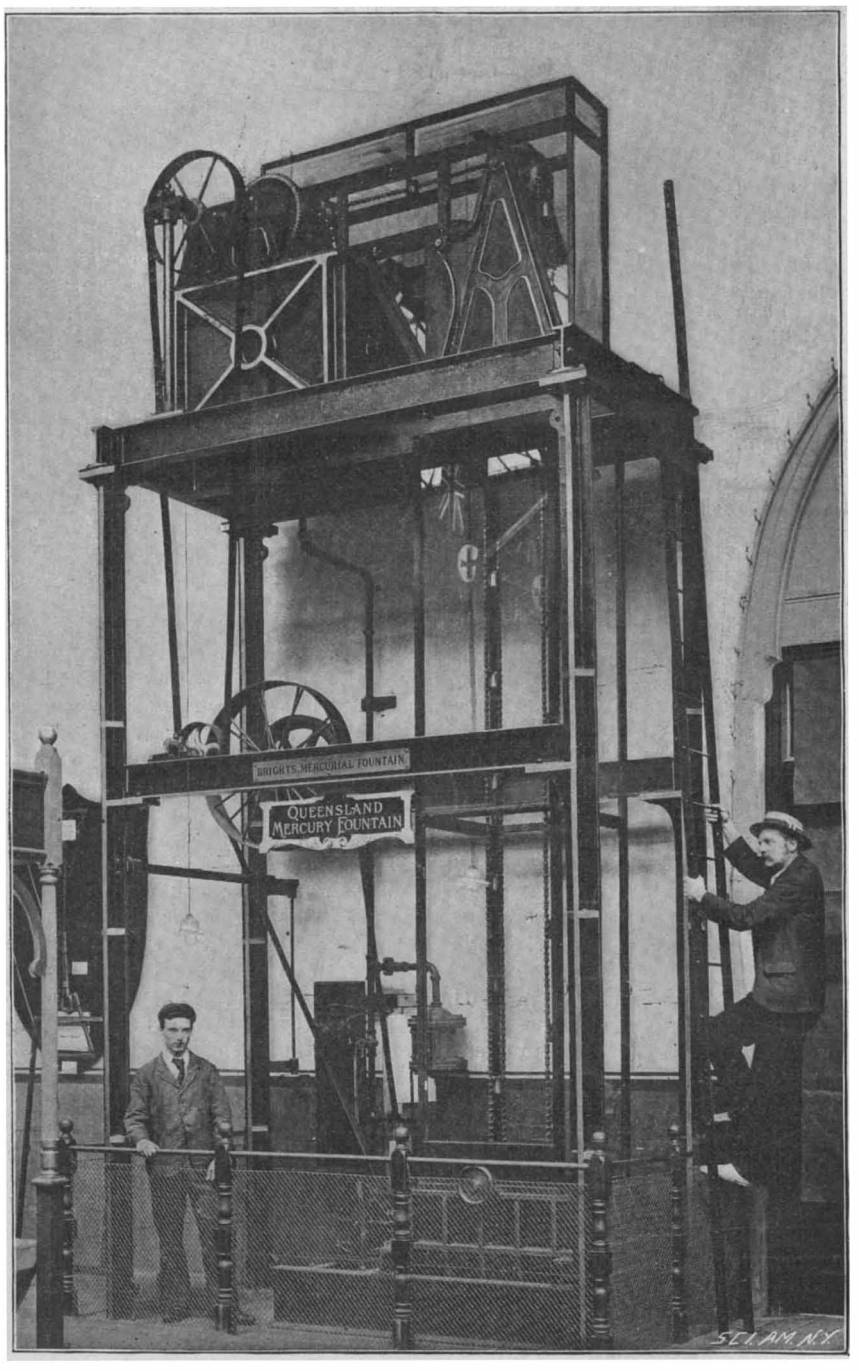
The lower basin is drained off by a drain pipe 80 feet in length and 1½ inches in diameter, which conveys the quicksilver to a tank conveniently placed, and, of course, at a slightly lower level. This tank acts as the means of supply to an elevator for furnishing the required head of the liquid mercury. The elevator is constituted by a number of small, stoutly built steel cups (3½ by 2¼), attached at intervals to an endless bicycle chain which is kept running through the store tank. As each freely suspended cup approaches the lower tank a tilting system enables it to pick up its cup full of mercury. The loaded cups are from here led up to a reservoir tank at a height of 14 feet above the other, where each in turn empties its contents. From this reservoir the quicksilver is carried through a pipe some 100 feet in length and 1 inch in diameter back to the upper bowl of the fountain. On its way, however, the mercury is run through a fine wire gauze filter which frees the running mercury from the impurities which superficially collect from the atmosphere.

The 2½ tons of mercury employed for this striking apparatus represents alone some $2,970 in value.

Each of the tanks has about 2 cubic feet of mercury in it. The number of elevator buckets is twenty-eight, placed at 20-inch intervals along the chain; and as each holds some 10 cubic inches (5 pounds), the supply of mercury is worked at a rate of over 7 tons per hour. Both the delivery and return pipes are lined with glass (mainly to reduce friction to a minimum), and the head of mercury in the reservoir tank is equivalent to 6 feet above the height of the top basin. The elevator is most satisfactorily worked by a 2 horse power electric motor of the new Langdon-Davies (alternating current) pattern.

Both the fountain itself and the machinery to work it are lighted by electricity, and the effect at night of the spray of mercury falling, with the light glistening between, is truly entrancing. The only gold medal of this show has been awarded to Mr. Bright for this highly ingenious and novel invention.

QUICKSILVER FOUNTAIN AT EARL'S COURT, LONDON.



ELEVATOR AND TANKS FOR OPERATING QUICKSILVER FOUNTAIN.

PAPER may be rendered fireproof for making flashlight reflectors or for other purposes by moistening with the following solution: Ammonium sulphate, 8 parts; boric acid, 3 parts; borax, 2 parts; water, 100 parts; sodium tungstate can also be used, and a solution of common alum is often efficacious, but it tends to loosen and disintegrate the paper.

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Our Growing Trade in China.

American products seem to be gaining favor more rapidly in China than those of any other nation. The report of the Inspector-General of Customs of China for the year 1898, just received by the Treasury Bureau of Statistics, shows an increase of nearly 40 per cent in imports into China from the United States, while the increase in total imports is less than 5 per cent. Our imports into China in 1898 were 17,163,312 Haikwan taels, an increase of 4,723,010 taels over 1897, while those from Great Britain, our most active rival in Oriental trade, fell from 40,015,587 taels in 1897 to 34,962,474 taels in 1898, and from the Continent of Europe the 1898 imports also showed a reduction of nearly 1,000,000 taels. The imports through Hongkong are largely of European origin and amounted in 1898 to 97,214,017 taels, against 90,125,887 taels in 1897. Even if all the imports into China from Hongkong and Macao are of European origin, combining them with those from Great Britain and the Continent of Europe, they show a gain in European products imported into China in 1898 of less than 1 per cent, while those from the United States, as already indicated, show a gain of nearly 40 per cent. The value of the Haikwan tael, according to the latest estimate of the Director of the United States Mint, is 71 8 cents.

Fig. 4.—A BICYCLE BUILT FOR A HEAVYWEIGHT.

Our principal exports to China are cotton goods, kerosene oil, flour, provisions, railway material and engines, manufactures of iron and steel, manufactures of wood, and manufactured tobacco. The Chinese customs service, as is well known, has been for many years administered by Englishmen selected for that service by the Chinese government because of their familiarity with customs laws and commercial methods throughout the world. Their reports relating to the commerce of the year 1898, comparing it with that of previous years, contain many interesting statements showing the gains which American products are making in the import trade of the empire.

The Statistical Secretary, Mr. F. E. Taylor, in his general report on the Commerce of China for 1898, says: "The value of the trade in cotton piece goods has remained practically stationary for three years, but there are certain movements in the trade which deserve attention. Dutch goods are rapidly losing ground; Dutch sheetings have disappeared; they cannot keep pace in price or quality with those of the United States. Manchester can no longer compete with the United States in the exportation of drills, jeans, and sheetings, owing to the lower prices at which the latter country can land this class of goods in China. White and refined sugar and American flour are being bought more freely, which, as indicating increased ability to purchase luxuries, may be taken as a sign of prosperity."

Customs Commissioner Huges, of Kiukiang, speaking of the progress of the kerosene oil trade, says: "The American oil still maintains its supremacy, and judging by our figures of the last two years, seems to be leaving its Russian rival farther and farther in the background." Customs Commissioner Moorehouse, of Amoy, writes: "Imports of American flour increased considerably, 98,898 piculs (133⅓ pounds) being consumed, as compared with 52,089 in 1897. American flour can be laid down at a less cost than flour ground locally from native wheat." Customs Commissioner Walter Lay, of Newchwang, writes: "Both American drills and American sheetings have come into great favor here, the demand for them having become quite phenomenal." Customs Commissioner Hippisley, of Tientsin, says: "The imports show a net value of 32,600,000 taels, or 2,400,000 taels over that of 1897. Cotton piece goods advanced from 14,750,000 to 16,000,000 taels, all of which is practically due to increased receipts of American makes, which now represent about one-half of this branch of the trade."

All of which clearly indicates to American manufacturers and exporters the truth of the maxim that "nothing succeeds like success." The success of the American navy in Pacific waters last year is doubtless largely responsible for bringing our national being more emphatically before the half-wakened buyers of the Orient. Now, while we are on an upward wave, is the time for those having goods suited to that trade to bring them into active competition with those of Europe. And it should ever be remembered that China does not yet know what she wants, simply because she does not know what exists. There are countless articles of our production that will there find an enormous market if their utilities are once explained to them, of which the Chinaman is to-day in absolute ignorance of even the need for.

An Ancient Barrel Organ Unearthed.

Barrel organs were formerly quite frequent in English churches, and one has recently been unearthed in a church near Rochester, England. It has six stops and six barrels and is capable of grinding out sixty tunes in all. Among them are such archaic specimens as "Job," "Old 11th." The organ was operated by the sexton.

A Novel Apparatus for Teaching Geology.

Strange to say, there are few pieces of apparatus which can be obtained in the world to-day which will assist in teaching geology. One of the most interesting we have seen was designed by Professor G. A. Lebour, of Durham College of Science, Newcastle-on-Tyne, and which was published in Nature. The machine is for making folds of rock, and as may be readily understood, a large number of fold forms of rocks can be reproduced, and their consequences, such as thrusts, faults, etc., can be demonstrated.

It consists of two parallel wooden rollers about 3 feet apart and 4 inches in diameter. A shaft at right angles turns the two rollers in opposite directions by means of toothed bevel wheels, the shaft itself being driven by a worm-wheel and worm. One turn of the handle causes only $\frac{1}{48}$ of the turn of the shaft and rollers, so that a very slow motion can be imparted to the latter. A sheet of India rubber is firmly attached by a slot and screwed to each roller. This completes the arrangement, the rollers being wound through about one entire revolution and the India rubber being thus stretched, and layers of cloth, clay, paste, or other material are laid upon it. The handle is then turned in the reverse direction and the India rubber is gradually released. Folds are in this way shown slowly growing, the broad elastic band simulating the contraction of a portion of the earth's course and producing various geological forms. Various weights may be applied and different effects can be obtained, thus giving an idea of the results which have actually been produced in nature under great pressure, that is to say, at great depths.

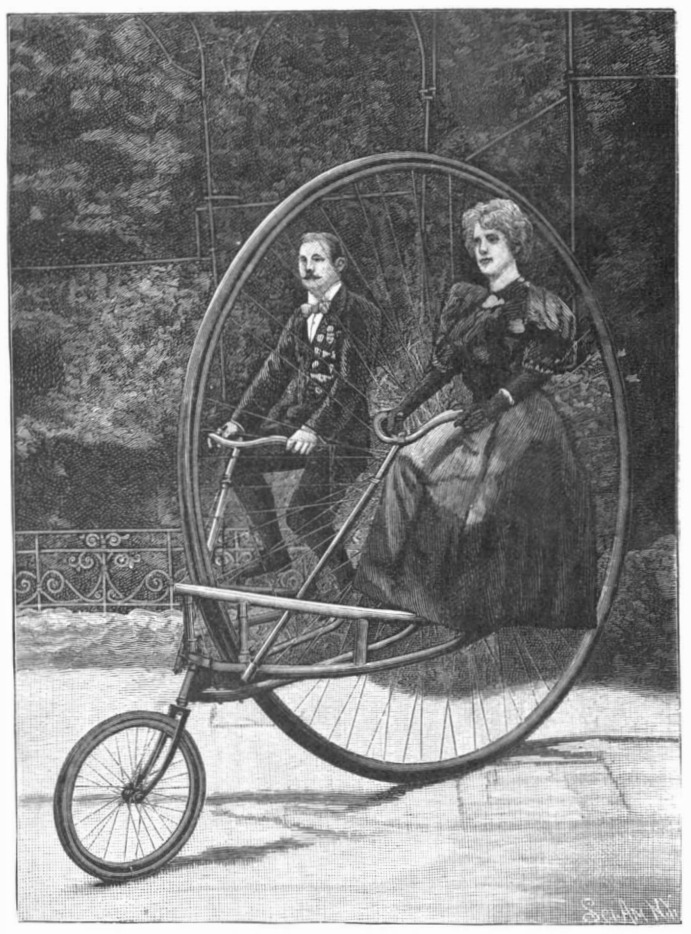

Fig. 3.—A BICYCLE BUILT FOR TWO.

GROTESQUE FORMS OF CYCLES.

We illustrate herewith, from Lectures pour Tous, some curious things in the way of cycle advertising that were to be seen at a "Great Cyclist Meeting" (as the programme of the affair styled it) that took place recently at Holburn Viaduct, England.

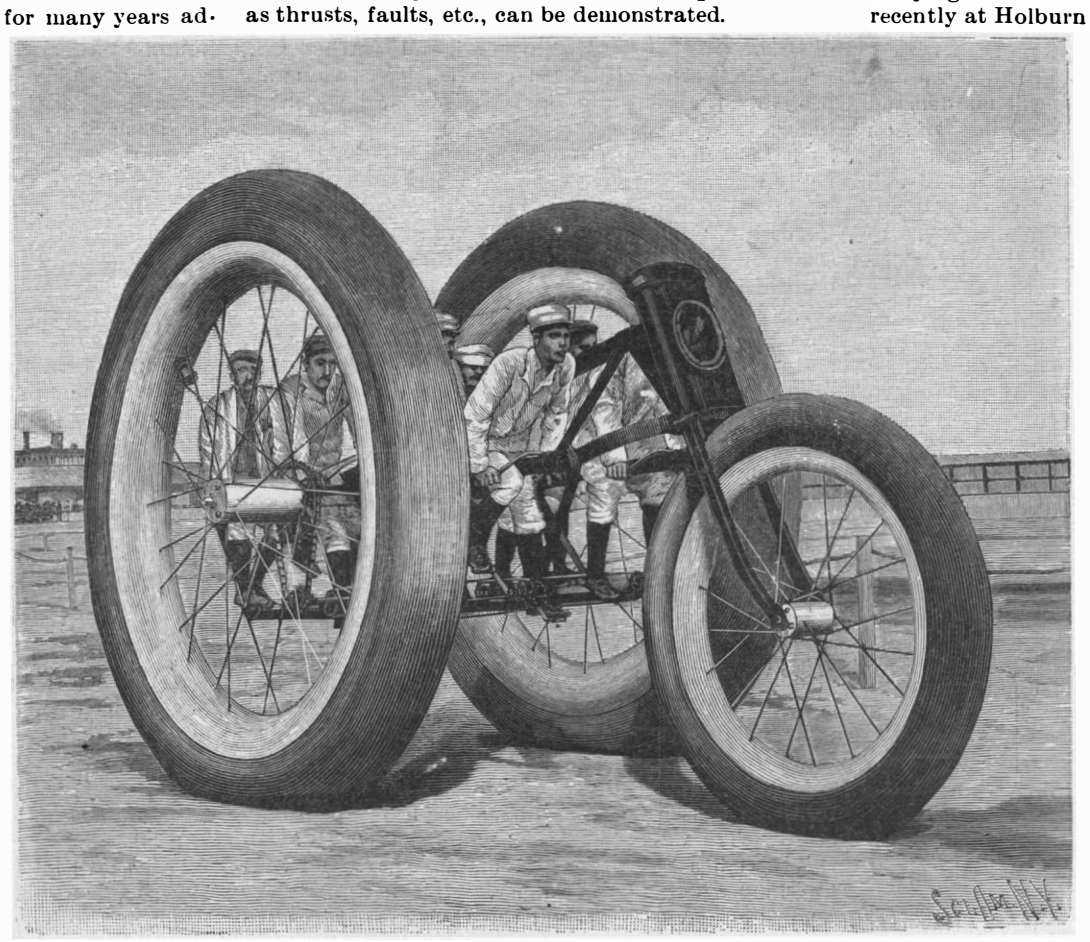

Fig. 2.—THE LARGEST TRICYCLE IN THE WORLD.

Fig. 1 represents a gigantic bicycle that was displayed by Messrs. H. A. Lozier & Company, the manufacturers of the Cleveland bicycle. It was, of course, constructed simply for show and as an advertisement of the firm's machines. Each wheel is 19½ feet in diameter and was provided with pneumatic tires 8 inches in thickness. The saddle is large enough to accommodate eight men. The size of the machine can be judged of by comparison with the bicycle of ordinary dimensions that is seen leaning against the front wheel.

Fig. 2 shows a huge tricycle constructed for the Wowenhoe & Rübler Company, of Boston, in order to serve as an advertisement for the new rubber tires of the Vim system. It was capable of carrying eight cyclists. The two driving-wheels are 13 feet in diameter, the steering-wheel 7½ feet. The wooden rims were provided with rubber tires 14 and 16 inches in thickness. Each driving-wheel hub is 16 inches in length. The steel spokes are one-fifth of an inch in diameter. The whole machine weighed 2,236 pounds.

Fig. 3 represents a bicycle called "The Sociable," devised

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by a German, Herr Karl Jatho, and ridden by himself and sister. Its driving-wheel is 8·2 feet in diameter and covers a distance of 19·6 feet in one revolution. The steering wheel is 16 inches in diameter. The weight of the machine is 112 pounds.

Fig. 4 shows a bicycle especially constructed to withstand the weight of the heaviest bicyclist in the world—a man named Grimes, who is said to tip the scales at 567 pounds, and who is 6 feet in height, with a girth of 62 inches around the chest and 22 around the calves. His muscles are said to be as hard and firm as those of a well-trained athlete. He rides a specially built wheel.

Tischendorf and the Sinaitic Manuscript.*

Tischendorf (privat-docent at the University of Leipzig in 1840) went down in 1844 to Mount Sinai searching for Bible manuscripts, finding, in something like a waste-basket, forty-three cast-off leaves from an Old Testament manuscript apparently of the fifth century and now, as "The Codex Frederico-Augustanus" (after the then King of Saxony), the property of the University of Leipzig.

The study of the find whetted his appetite; and, in 1853, he returned to Sinai, looked as carefully as permitted through the whole monastery, but found no trace of further manuscript (the monks having meantime waked up to the possible value of his first batch). He did not dare magnify values; hence would not ask for them. He therefore departed, having seen used in the binding of a book only two or three little bits of a continuation of his original find.

The publication of his first forty-three leaves created a tremendous stir in Europe and aroused the jealousy of other paleographers to its extreme pitch; so that his failure in further discoveries in the trip of 1853 he attributed to some Englishman's or Frenchman's having forestalled him. Years passing and the scientific societies' journals maintaining silence, he determined on a return; this time bearing a large sum of money and full credentials from the Emperor of Russia, the temporal head of the Greek Church, to which belonged the monastery at Sinai and its mother monastery at Cairo, Egypt. Reaching Sinai early in 1859, he studied the monastery's architecture and searched it thoroughly for leaves of the expected manuscript, finding nothing. Despondent, he ordered his camels; but on the eve of departure, invited to the monastery steward's cell, the steward took from his shelf a book, rolled together and tied in a red silk handkerchief, and handed it to Tischendorf as "something he had found lying about." Tischendorf discovered it to be the manuscript he had been fifteen years hunting, examined it rapidly, saw before him the whole of the books of the New Testament, the letter of Barnabas and that of the Shepherd of Hermas. Prior to that time the letter of Barnabas had not been found complete in Greek.

How the monks voted down the proposition of Tischendorf to surrender to him the Sinaitic manuscript; his journey to Cairo and the repetition of his demand to the mother monastery there; the transmission, on the latter's order, from Sinai to Cairo of the manuscript; Tischendorf's copying it, with the aid of two Greek scholars, under surveillance of the Cairo authorities; his final request for the original as a gift to the Emperor of Russia—is matter of history. The death of the archbishop delayed proceedings; the action sought demanded completeness in the monkish fraternity as an organization; and ten months from the finding of the manuscript they had elected a new archbishop and were ready to give the precious document, which was done, with due solemnity, in the presence of the consul-general of Prussia and the monks. As a return gift the Emperor of Russia awarded, by mutual agreement, five thousand and two thousand rubles, respectively, to the monasteries at Cairo and Sinai, besides conferring decorations on the chief monks.

For three years Tischendorf almost ate, drank and slept this Codex Sinaiticus—a treasure such as the Church had not known before, the first great uncial writing containing the whole of the New Testament. He went over line after line, column after column, page after page, making a fac-simile print, wherein he used five different sizes of letters made to correspond to sizes found in the manuscript, over which he worked from 1859 to 1862, when the four volumes were published in Leipzig under the auspices of the Emperor of Russia. He printed a title page for their appearance at the celebration of the millennial year of the Russian empire; but jealousy circumvented this use of the volumes. Three of the volumes contained the text proper; while the fourth included many plates—beautiful fac-similes of the different kinds of writing found in the Codex Sinaiticus. In the first part of the fourth volume he went over it line by line and letter by letter; and wherever there was any peculiar reading, any double writing—when a man had scratched out a letter with his knife and written another letter on top of it—he would say, "On this page and this line you will see that letter; and that letter was originally this letter, and that was scratched out and this was put in."

In 1863 Tischendorf made a smaller edition of the New Testament part. He also made an edition in 1865. The original Codex Sinaiticus to-day rests in the Russian Imperial Library.

When he had published the Codex Sinaiticus, he applied to the Pope for permission similarly to edit the Codex Vaticanus—a manuscript probably from the fourth century—that for centuries had lain in the Vatican Library, and access to which had been denied to all. He published about 1867 a partial edition of the Vatican manuscript.

The Sinaitic manuscript is made up of leaves 18 inches broad and about 18 high, each page having four narrow columns about 2 inches broad. The Vatican manuscript has three columns on a page. Books were formerly inscribed upon rolls, which in all probability were used until long after the time of Christ. Books with leaves were probably invented about the beginning of the fourth century. The Christians, in connection with their Jewish learning with reference to the Old Testament, were probably the first men who wanted to make quick references, to a very great extent, to a large number of books; and this doubtless impelled one of their number to devise the present form instead of the cumbrous rolls, 40 to 50 feet long (and not all the books of the Bible could be put upon one roll), which they had been obliged to roll up and unroll whenever they wanted to compare different passages (e. g. Matthew i. and Matthew xvi.)

The Codex Sinaiticus and the Codex Vaticanus are probably the oldest books with leaves of which we know. The text is nothing like the Greek Testament as it is read to-day, which has been polished up in many ways. The scribes did not always write off the manuscripts just as they had them before them. One might say, "I know better about that. I have heard something more about what Jesus said at that time;" or, at the beginning of the second century, one would say, "My father told me something else about that." Thus the text was changed in one way or another, and thus these old manuscripts show what we call an old text.

The old manuscripts were written altogether in capital ("uncial") letters straight ahead, without any division between the words, the reader taking time to make the division as he read. There are no Greek manuscripts, but the very youngest, that are good about dividing the words exactly from one another. We have one or two manuscripts in Greek written in connection with the Latin manuscripts; and they were careful to put a point in between each two words. Those were for men who knew just as little as possible, or nothing at all, about Greek; and it would happen occasionally to a scribe copying a manuscript that he put a point right in the middle of a word, thinking the word had stopped. This Codex Sinaiticus became, then, after Tischendorf had edited it and had carefully tabulated all these errors, one of the mainstays of New Testament criticism; and from that day to this there has been no Greek manuscript found that has, in any way, taken its place.

The Codex Vaticanus and the Codex Sinaiticus are the two manuscripts to which we are obliged most to refer respecting the New Testament. Both contain errors. Should we take such a manuscript and print right straight off without textual criticism? The manuscripts of the classical authors can be counted on the fingers as a rule; but in the case of the New Testament we to-day have some three thousand Greek manuscripts as its basis; and there probably exist in the world to-day some two or three thousand more of manuscripts that we have not yet collated. A Christian wants to have his New Testament just as scientific as he can. We have Browning, Dante and Shakespeare societies. People want to know whether their favorite author wrote this word, or that word, in this way or that way, and whether Shakespeare has been misrepresented in certain passages. So, as to a Scripture writer, we ask whether he said this Greek word or that Greek word; we ask whether this fits into the matter of the text or not; and we are working very hard to get the proper text of these books. A Christian must be at pains to have the very best possible text of the New Testament; he must not be satisfied with an "i" that is not dotted, with a "t" that is not crossed; he must not be satisfied to have any word in that Testament other than as good and as accurate as it can be made.

With the advances of palæography and philology, it is possible for us to make a New Testament text better than any text which existed after the New Testament text had passed fifty years from the original—after it was no longer possible to take the words from the original—to read them from the original page.

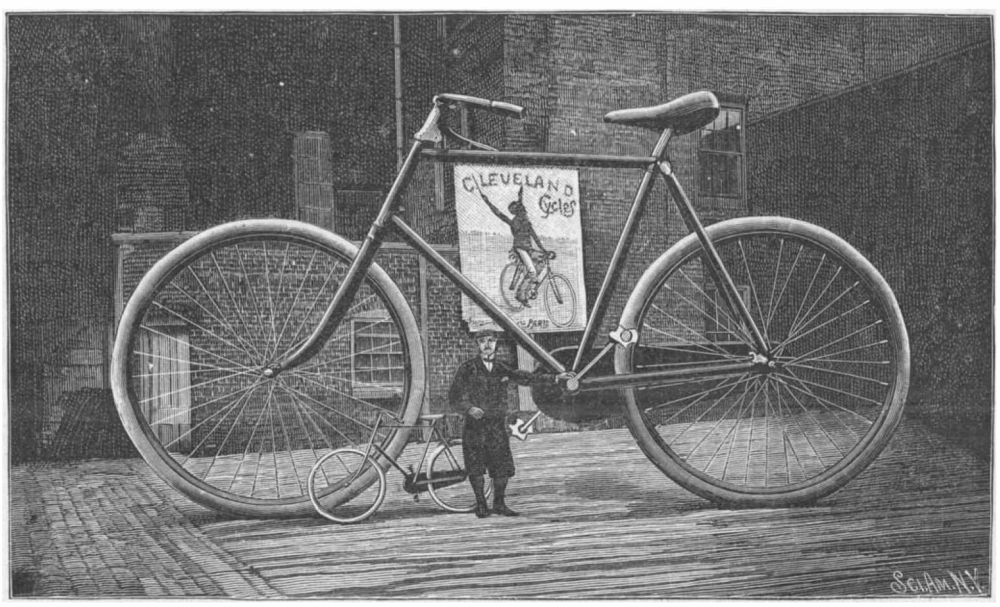

Fig. 1.—A GIGANTIC BICYCLE.

The History of Appendicitis.

The entire literature of appendicitis down to the year 1899 numbers no less than 2,500 articles, books, etc., and in a recent number of The Medical Record Dr. George M. Edebohls, A.M., M.D., has a most interesting review on the "History and Literature of Appendicitis." He says its early history cannot be traced owing to the fact that it was confused with other diseases. Probably the first reference to it dates from 1642. As late as 1838 the knowledge of the existence of appendicitis was by no means general. In 1846 cases began to be reported. The inauguration of modern surgical treatment of appendicular abscesses did not come until 1867, and the first recorded operation on the appendix was planned and executed on August 24, 1883. The early operations commonly ended in failure. The first successful removal of the appendix was performed on May 8, 1886. Since that time the number of successful operations has greatly increased until, while now it is regarded as a serious, it is by no means a fatal operation. There is much popular misconception as to the origin of appendicitis, and Dr. Edebohls gives interesting accounts of some things which have been found in the vermiform appendix, from which it will be seen that the grape seed is by no means the commonest form of injury. Coproliths have been found by everybody who has had much to do with post mortem investigations or with operations on the appendix. Next to them pins have been the foreign bodies most frequently met with. Other things found are grape seeds, melon seeds, a chocolate nut, a grain of oat, cherry stones, raspberry seeds, prune seeds, orange seeds, date seeds, tomato seeds, fruit stones, huckleberry seeds, blackberry seeds, hazelnut shell, a piece of chestnut, peanuts, hair, bristle, a glazier's point of zinc, a globule of solder, a gelatine capsule, a piece of bone, a piece of screw nail, a rifle cartridge and the fin of a fish. This paper also shows that four per cent of all women have appendicitis, and they are a very little more liable to the disease than men.

To Our Subscribers.

With the present issue, the SCIENTIFIC AMERICAN closes the fifty-fourth year of its existence. It is only fair that we should call the attention of our readers to the fact that the sending of the paper is discontinued at the end of the subscription year. We therefore beg those whose subscriptions expire with this issue to remit promptly in order that the paper may be received without interruption.

Readers of the SCIENTIFIC AMERICAN who are still unfamiliar with our other publications can receive sample copies upon request. When the SCIENTIFIC AMERICAN and SUPPLEMENT are taken together, a special discount is made which places the two papers within the reach of all.

IT is said that in Japan extensive preparations are being made for lighting railway cars by acetylene gas. According to The Railway Review, the carbide is to be manufactured by a native concern.

* Abstract of a lecture at Haverford College, Haverford, Pa., by Prof. Caspar Rene Gregory, of the Theological Faculty of the University of Leipzig.

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Correspondence.

Hop Picker Wanted in England.

To the Editor of the SCIENTIFIC AMERICAN:

As you from time to time publish lists of various inventions wanted, I thought you might like to know that in this county, Kent, a great many people are employed in the hop picking season to pick hops; and in a year such as the present, when hops are very abundant, there is a great difficulty in getting enough hands to do the work, and as a consequence, the crop often drops off before it can be picked, and is wasted. It seems to me that there is an opening here for a machine to do the hop-picking, and it may be that American ingenuity might be able to supply this.

WALTER WINANS.

Surrenden Park, Pluckley, Ashford, Kent.

Public Interest in the Navy.

To the Editor of the SCIENTIFIC AMERICAN:

Please accept my thanks for the trouble you have taken to give me the information I desired regarding the use of Krupp or Harveyized armor on the battleships of the "Maine" and "New Jersey" classes.

I have followed with keen interest and appreciation the efforts you have made toward the improvement of our navy, both by stimulating popular interest in the matter and by well timed criticism of departmental plans, e. g., in the cruisers of the "Denver" class, and the new monitors, and feel that you are accomplishing much toward securing the general adoption in these matters of the standard of excellence which should obtain, viz., that the very best may suffice for us, but that nothing less will.

Hoping that you will consider that the data which you have kindly procured for me contributed to the furtherance of your own wishes in these respects, believe me, Faithfully yours,

EDMUND M. PARKER.

Boston, December 7, 1899.

Automobiles at the Paris Exposition.

It has been virtually decided that the administration of the Paris Exposition of 1900 will intrust to the Automobile Club of France the arrangements to be made for the automobile part of the Exposition. This will occupy the annex which is to be formed in the Vincennes Park. The sum of 100,000 francs has been allotted to the section of automobiles, and it is expected that a brilliant display will be the result, with a series of races and other competitive tests between the different types of automobiles. The sum mentioned will be expended under the direction of the club, and will be devoted to the establishment of race tracks and stands and for the distribution of prizes. To these prizes will probably be added the distribution of medals and diplomas by the administration of the Exposition. The principal events will be four competitive tests for automobiles of all types. These will be classed as follows: 1. Private automobiles of all descriptions, such as coupes, phaetons, etc. 2. Cabs and similar vehicles, whose limit of weight is 500 kilogrammes. 3. Heavy automobiles, such as transportation and delivery wagons, weighing up to 1,200 kilogrammes. 4. Light vehicles of all kinds. For the use of the electric automobiles, a special generating station will be erected near the Park, where all facilities for charging the accumulators will be provided. Besides the tests above mentioned, a series of long distance races will be organized, starting at the Park and making a series of circular routes near the city. A unique feature of these races will be the establishment of an electric indicator, consisting of a large board upon which the route is traced, over which will be moved electrically a series of minute automobiles, reproducing exactly the position of the vehicles. Besides this, news will be brought by optical and by wireless telegraphy.

THE total production of tin in 1898 has been estimated at 77,300 tons; in 1890 it was but 55,100 tons. The greater part of the tin comes from the Malay Peninsula, which furnishes 60·6 per cent, not counting the Dutch East Indies, which give 19 per cent. Following this come Australia, with 7·9 per cent; Cornwall, 6·1; and Bolivia, 7·9 per cent. It may be remarked that forty years ago Cornwall furnished 50 per cent of the total. The most productive region is that part of the Malay Peninsula extending from Burma and Siam to Sumatra. A considerable proportion of the tin which is taken from this region is carried into China, and thus escapes the control of statistics. In the Australian region the chief center of production is Tasmania. The principal consumers for 1898 have been the United States, 25,000 tons; Great Britain, 13,000; Germany, 14,500; and France, 8,500 tons. The exportation of tin plate from Great Britain has been 251,769 tons, and that country consumes 150,000 tons. The production of America for the year is estimated at 327,000 tons. The total production of tin plate is estimated at 750,000 tons, and the tin required for its manufacture reaches 20,000 to 25,000 tons.

Science Notes.

A famous Italian faster has been unmasked at Rio de Janeiro. A physician found that he used fibrous meat compressed into the smallest size, and this, in connection with a small quantity of mineral water, was enough to prevent starvation.

The new Victoria and Albert Museum, as the old South Kensington Museum is now called, is having a new building constructed. The frontage on Cromwell Road is 700 feet. The area of the new buildings will be equal to the whole of that covered by the existing museums, including temporary sheds on the west side of the Exhibition Road.

It is an extraordinary fact that up to the present time dead animals were left to decompose on the Paris streets, as there were no facilities for removing them. The Prefect of Police has at last taken steps to have such nuisances removed on application. The cost is not to exceed $1. This is to be paid by the applicant. This seems a rather extraordinary sanitary regulation.

Excavations carried on at Beneventum, under the direction of Prof. Baccelli, have revealed in perfect preservation a theater as large as that of Pompey or Marcellus at Rome. This is, says The British Architect, quite the most important discovery of the official searches in recent years, though in Rome and at Pompeii something noteworthy is unearthed almost every day. The theater is built of great blocks of travertine.

The necessity of mechanical ventilation in the case of crowded rooms and the importance of natural ventilation was shown at a recent Sanitary Congress. The gain by introducing good ventilation in offices where clerks are crowded together would doubtless be even more marked than in the case of the theater. It is usually considered that 1,000 cubic feet of air an hour is what is required by a single person, but at the Opera House at Vienna the figure was 1600 cubic feet.

An unerring index of prosperity in the West is found in the returns of the smaller colleges, whose clientele is drawn for the most part from the farming communities. The tuition fees and cost of living at these institutions are small, which, when coupled with the increased prosperity of the West, accounts in part for the long lists of students. Ohio has 39 of these institutions; Illinois, 31; Iowa, 23; Indiana, 14; and Michigan, 11. They all do valuable work, and do not compete to any great extent with the great universities.

The shape of Porto Rico on our maps is aggressively square, unnaturally mathematical, and is an exception among islands, which are apt to be of most irregular shape; and our new possession is now being charted anew, and the appearance of it on the new maps will be something of a surprise. The appearance of the east coast line will be profoundly modified. Before a twelvemonth will have elapsed, the shape of the queer parallelogram will be changed. The straight up and down east boundary will prove to slope off gradually to the northeast. It is considered that this error in the shape of the island was due partly to lack of scientific knowledge on the part of the Spaniards and partly to a desire to keep commercial rivals at a distance.

The coming performance of the "Passion Play," which should be begun on May, 23, 1900, is now beginning to attract public attention. Those who had the great pleasure of attending the play in 1880 or 1890 were surprised by the artless simplicity of the native inhabitants of this little Bavarian village. If they should visit the town to-day, however, they would find that all is changed. The old stage is all that remains of the theater. A gigantic steel framework is now being erected to shelter the audience. It reminds one of the camp meeting tabernacles and convention halls in America. Instead of billeting strangers upon the inhabitants, as was formerly the custom, extensive preparations are being made to entertain them, and the talk of the town is how many foreigners will be induced to visit Ober-Ammergau during the period of the play. The names of the actors have not been announced as yet.

The London Lancet has sounded a note of warning against the dangers of high altitudes for elderly people. If at a height of more than 4,000 feet to 5,000 feet above the sea level a certain amount of strain is put on a normal heart, and by a rise of pressure indirectly also on the large peripheral arteries, must not this action be multiplied in the cases of heart troubles or in the cases of arteries with thickened or hardened walls? It is specially the rapidity of the change from one altitude to another which must be considered as a call made upon the contractibility of the small arteries on the one hand, and on the amount of muscular force of the heart on the other hand, and if the structures in question did not respond to this call, rupture of an artery or dilation of the heart may ensue. In the case of people totally unaccustomed to high altitudes, it is desirable to take them by degrees, in two or three stages, with a stay of one or two days at the intermediate places.

Engineering Notes.

There are 2,090 miles of railway open for traffic in New Zealand.

There are 10,000 miles of railway now in operation or under construction in Africa. According to The Engineer, already 1,400 miles of line northwest from Cape Colony and 1,100 miles southwest from Cairo are complete, the intermediate distance being about 3,000 miles.

One of the old Stockton & Darlington engine drivers has just retired from active service. He has been an engine driver since 1853, and in the forty-six years has traveled nearly 2,000,000 miles on the footplate of his engine.

Metal never rusts in the waters of Lake Titicaca. A chain or an anchor can be left in it two weeks, and will be as clean and bright as when it came from the foundry, which is probably owing to the action of some of the chemical salts in the water.

An amusing story comes from the Cape and is told by The Engineer. The station master at a junction on the way to De Aar was notified of a "goods train" arriving. It came and disgorged, not goods, but armed marines. Later on steamed up an armored train with bluejackets and having guns covered with a tarpaulin and ironically labeled "Fruit."

The French military authorities are planning the creation of six railway regiments. The war in the Transvaal has shown what an important part railway operations will play in all future conflicts. According to The Railway Review, the regiments will be recruited among railway employes, and they will be drilled in running trains, repairing and destroying tracks, telegraphing, etc.

An acetylene gas plant has been erected at Assam, which shows that the ease with which this gas can be generated from calcium carbide should gain for it wide favor in parts of the world where it would be impossible to have a gas or electric light plant. The lack of a good illuminant is often felt severely by colonists and others in far-away parts of the world, and acetylene is a welcome relief from kerosene oil and candles.

In most dining cars the kitchen is situated at one end of the car, opening into a passageway inside of the car, and the fumes of cooking and occasionally smoke are wafted into the car while passengers are at the table, but all of the dining cars of the New York Central are being constructed so that there will be no opening from the kitchen to the interior of the car. The only approach to and exit from the kitchen is by way of the platform vestibule, about half of which is made part of the kitchen.

A simple method of getting rid of superfluous obsolete railway rolling stock has been adopted at a foundry in Michigan where a large number of cars were received from a railway company. The only part of the cars worth saving was the metal, and the problem was to separate it from the timber at small cost. Two inclines were built, and two trains of cars were released at the top of the incline and allowed to collide at the bottom. The wreck was then burned and the iron collected.

At the new Boston Terminal Station a test was recently made with the air pumps of locomotives to operate the electro-pneumatic interlocking system of switches and signals. As The Railway Review says, any stoppage of the signaling system in the new station would cripple the enormous traffic, and would probably affect 100,000 suburban passengers, so that the utility of the test is evident. Pumps were used on three locomotives for the test. The pressure was carried to 90 pounds per square inch, and 122 cylinders, 148 semaphores and 283 switches were thrown. As the air compressor plant is in duplicate, it is not probable that there will ever be occasion to resort to the use of locomotives.

Dr. Ludwig Mach has successfully alloyed aluminium with magnesium and thereby obtained a compound which can be worked like brass, and which is lighter still than aluminium, says The Iron Age. The densities of the two metals are: Magnesium, 1·75; aluminium, 2·75; they both melt at 800° C., and their dilations amount to 0·023 and 0·027 mm. per meter and per degree Centigrade. The metallurgical properties depend upon the composition of the alloy. A 10 per cent magnesium alloy resembles zinc, a 15 per cent alloy is like brass and a 25 per cent like a compound bronze. The alloys can be soldered, it is stated, though that point does not appear to be fully settled, keep well in dry and damp air and give good castings. The alloy is almost as white as silver and so hard that it is possible to cut aluminium with a sharp-edged piece of magnalium. It can be turned, bored, etc., quite as well as brass, and clean and neat threads of ¼ mm. pitch can be cut with ease. It does not file so readily as brass, but is superior in this respect to copper, zinc and aluminium. Magnalium is suitable for lens mountings, and would make good divided circles and arcs for instruments in which light weight is a consideration. If bought by volume, it is a little less expensive than brass.

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THE RECONSTRUCTED CRUISER "ATLANTA."

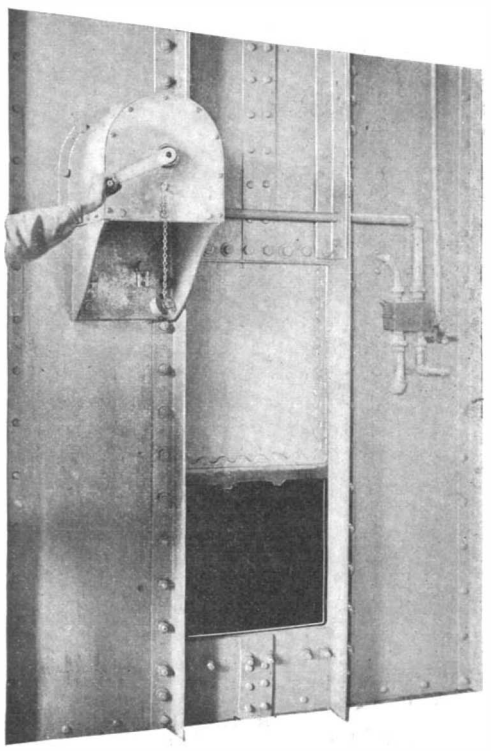
Not the least important branch of the work accomplished by the Bureau of Construction and Repair is that of reconstructing, or what we might call rejuvenating, the older cruisers of the navy. For obvious reasons this work is not so attractive or so much in the public eye as the construction of new battleships and cruisers, although it is in its way quite as important. The reconstruction of our earlier ships, which is being steadily and very ably carried out, chiefly by Naval Constructor Bowles at the New York navy yard, saves many a good ship from being relegated to the reserve list, if not to that of the obsolete or condemned. The latest cruiser to be thus overhauled and refitted is the "Atlanta," of which we present illustrations on the first page of this issue.

The "Atlanta" was one of the three first vessels to be built for the new navy. As launched, she was a semi-protected cruiser of 3,000 tons displacement and 15·6 knots trial speed. Her protective deck of 1½-inch steel was only partial, and covered merely the engines and boiler spaces, the ends of the vessel being unprotected. This is a method of construction whose faults are so obvious that it has been abandoned for a number of years, although we regret to see that it has been adopted once more in our six new cruisers of the "Denver" class. The original armament of the "Atlanta" consisted of two 8-inch guns carried on the main deck behind shields and six 6-inch guns mounted in broadside on the main deck within the superstructure. There was also a battery of small rapid-fire guns.

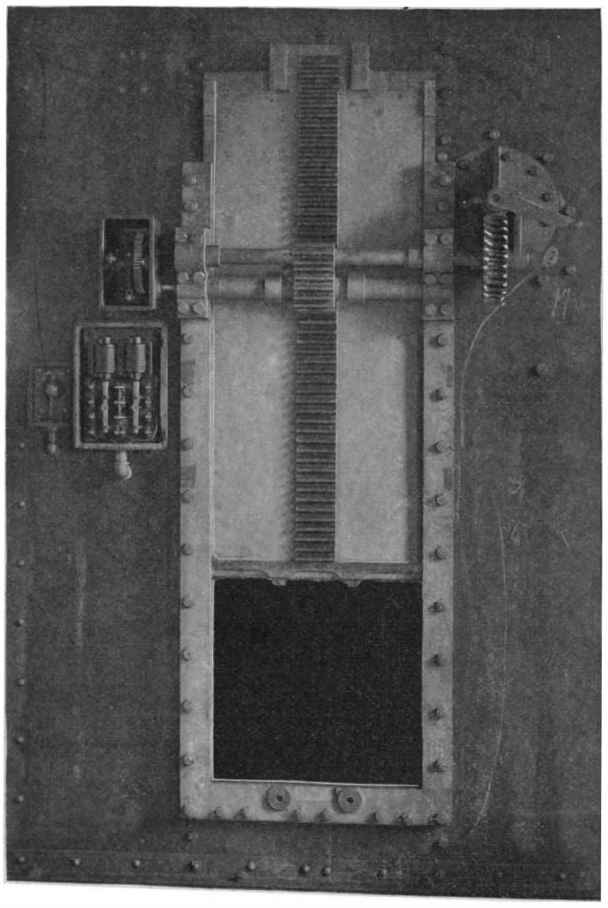
The work of reconstruction has been very complete. The old horizontal, compound engines have been changed to triple-expansion by the addition of a high pressure cylinder. At the same time the eight old, single-ended, Scotch boilers have been removed and replaced by two single-ended Scotch boilers and four Wilcox & Babcock water-tube boilers, the Scotch boilers carrying 180 pounds of steam and the Wilcox & Babcock 250 pounds. This change has not only greatly increased the boiler capacity, but it has reduced the bulk of the installation sufficiently to allow the construction of an athwartship coal bunker, which will increase the total coal capacity of the vessel by 80 tons, or about 17 per cent. These changes are expected to result in an increase of the vessel's speed from 15½ to 17½ or possibly 18 knots speed.

The ship's main battery, which was formerly of the short-caliber, slow-firing type, has been entirely renovated. All of the guns, including the two 8-inch bow and stern weapons, are of the rapid-fire type, the sights being mounted upon a sleeve in which the gun recoils and the breech mechanism being brought fully up to date. Although the new 8-inch guns are not officially known in our navy as rapid-fire, they do actually possess the characteristics which mark the so-called rapid-fire guns of this size in foreign navies.

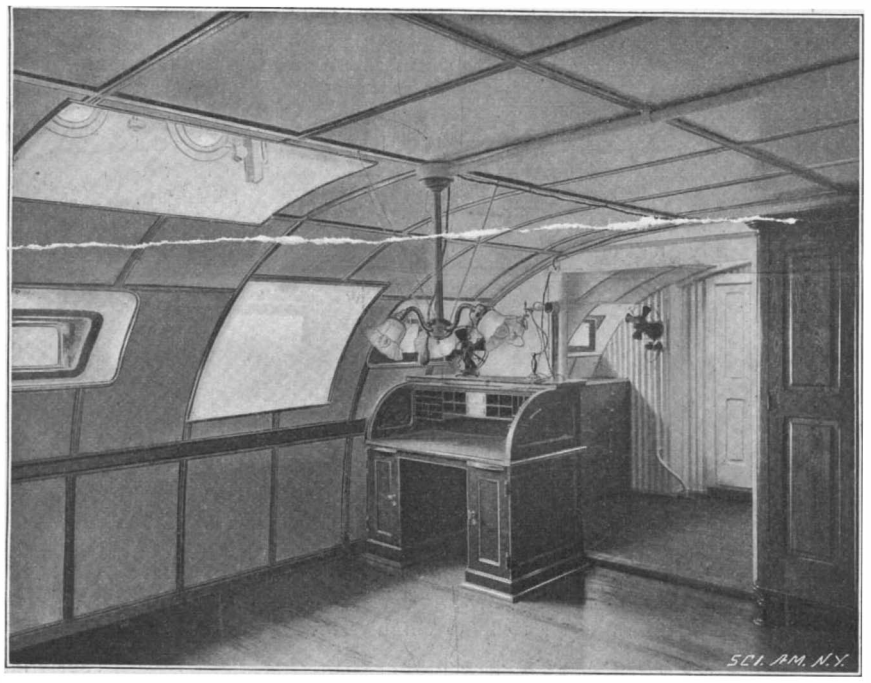
The lessons of the late war have been turned to good account in the work of reconstruction, for the "Atlanta," on and above the main deck, is absolutely stripped of combustible material; and if she is ever called upon to fight, there will be no fear of her being prematurely put out of action by the burning up of the wooden decks, bulkheads, and furniture. We present two illustrations of the captain's room which strikingly illustrate the changes that have been made. One of these represents the cabin as originally fitted. It shows the wooden bulkheads and elaborate paneling, both outboard and on the ceilings and bulkheads, and the characteristic heavy furniture. All of this woodwork was more or less, and generally more than less, highly inflammable. In the process of refitting, the wooden bulkheads were removed and the panelings stripped from the ceiling and from the outboard turtleback. Their place was taken by corrugated metal for the bulkheads, a coating of cork paint for the ceiling, and a covering of asbestos on the outboard walls. The wooden furniture is replaced by furniture of metal, one piece of which, a neatly designed roller-top desk, is shown in the engraving. The asbestos sheathing possesses the requirements of a non-conducting, incombustible, splinter-proof covering. The asbestos fire-felt is laid over wire cloth which is attached to a framework of light angle-bar, carried between the ship's frames or bulkhead stiffeners. The felt is flush with the surface of the frames, or the edges of the angle-bars, and asbestos millboard, three-eighths of an inch thick, is placed over the fire-felt to secure a smooth, hard finish, and it is held in position by galvanized iron moldings. The millboard is coated with sizing to prevent absorption, then painted with white enamel and striped with gold, the result being a pleasing panel effect. The asbestos sheathing has a light, cheerful appearance; it is warm in winter, cool in summer, and is free from the "sweating" which is such an insuperable objection to the use of the plain steel partition. The changes in the captain's cabin are typical of the work which has been done throughout the whole of the officers' quarters. One notable change which is conducive to convenience and cleanliness is the designing and putting in position of a folding metal berth, which in the daytime can be folded against the wall and screened by a curtain. For reasons which are only too well known to those who sleep at sea, the substitution of an open and accessible metal berth for the old, fixed wooden bunk will be greatly appreciated.



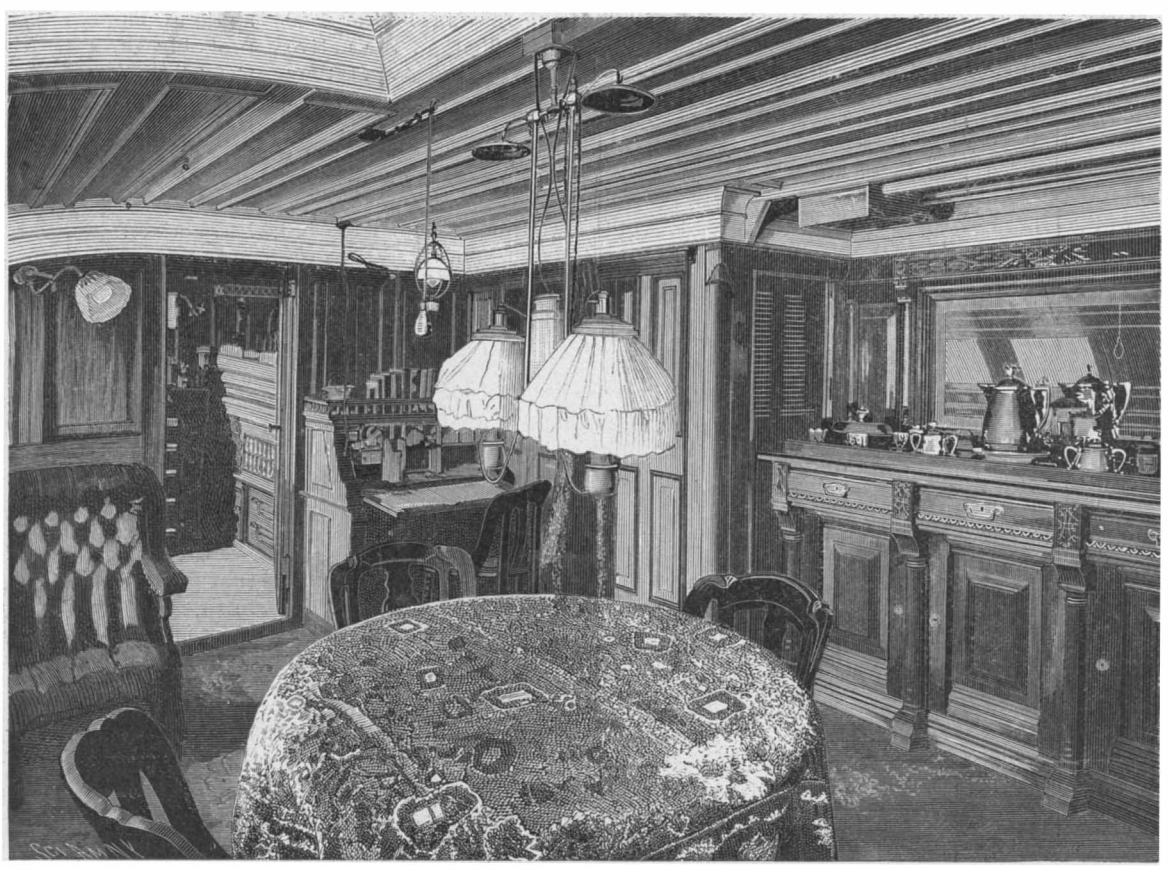
REAR VIEW OF DOOR, SHOWING ELECTRIC MOTOR CASE, WITH HAND-OPERATING CRANK SHIPPED.



FRONT VIEW OF WATERTIGHT DOOR, SHOWING RAISING AND LOWERING GEAR AND ELECTRIC CONTROLLING DEVICES.



U. S. S. "ATLANTA"—CAPTAIN'S CABIN AFTER FIREPROOFING.



U. S. S. "ATLANTA," SHOWING WOODWORK IN CAPTAIN'S CABIN BEFORE REFITTING.

Other evidences of the thoroughness with which Naval Constructor Bowles has carried out the work of fireproofing is further seen in the new metal rifle racks for the marines, metal lockers for the gun division, the substitution of wire screens in place of wooden bulkheads for the executive office, metal ladders and numberless other substitutions of metal for wood. On the superstructure deck the old wooden chart house has made way for a new steel structure with circular lights. All of these changes have been made under the immediate supervision of Assistant Naval Constructor Watt, to whom we are indebted for courtesies in the preparation of the present article.

The work above the main deck looking to the safety of the ship from fire finds its match below deck in an entirely new system of watertight, electrically operated doors, which have been designed by Naval Constructor Bowles and receive their first installation in a warship on board the "Atlanta." We

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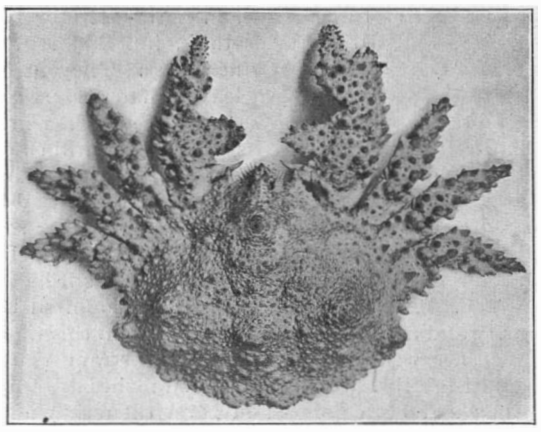
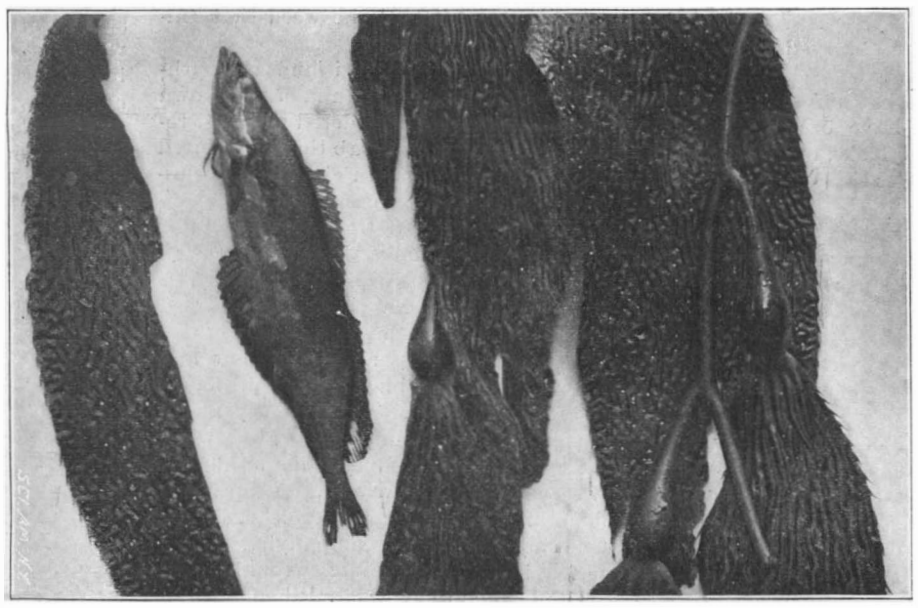
have had the opportunity of inspecting the operation of the door, and it impresses us as being an admirable solution of this difficult and most vital problem. Briefly stated, the absolutely essential elements of a successful watertight door system are first that every door may be closed simultaneously and instantly from the bridge or some central station, and that some telltale announcement shall show that they are closed; secondly, that it shall be possible to raise and lower each door independently, and from either side of the door, without conflicting with the operation from the bridge; thirdly, that it shall be possible to close the door either against a rush of water or through coal which may have accumulated in the doorway. These features, with others of minor importance, are all fulfilled in the present instance. The clear opening of the door can be of any desired size; for coal bunkers as shown in our engravings, it is generally about 4 feet 6 inches by 2 feet. The door is a steel plate riveted to a sliding frame. The guide-frame of bronze is bolted to the bulkhead, the guides being tapered $\frac{1}{16}$ of an inch to the foot. The sliding-frame is made with eleven wedges of the same taper as the guides, there being four on each side, two on top and one on the bottom. The surfaces nearest the bulkhead of both the guide-frame and the sliding-frame are scraped surfaces which form a water-tight joint by the wedge action which occurs during the last half-inch of closing. The guide-frame is open at the lower edge to prevent clogging or jamming.

The door plate carries a bronze rack into which gears a pinion keyed to a horizontal shaft which is carried at the top of the guide-frame. This pinion engages a smaller pinion on a second horizontal shaft, at either end of which is keyed a worm wheel, which in its turn engages a worm. The worm-shaft passes normally through the bulkhead and is driven by a one horse power electric motor, which is carried in a watertight casing on the opposite side of the bulkhead. Crank shafts are provided, which slip over the hexagonal end of the worm-shaft on either side of the bulkhead. and may be used for hand operation of the doors. The motor is compound-wound and of the short shunt type, the short shunt coils being relatively weak and wound outside the series coils. The circuits are so arranged that for raising the door only, the series coils are in circuit, giving a quick and easy starting; while for closing the door, where it may be necessary to cut through coal or other obstructions, the shunt and series coils are both in circuit. The current is controlled by a three-point spring lever switch on each side of the bulkhead. The switch is normally in its central position, in which the door closing circuit may be completed from the bridge or from any central station in the ship The door-opening circuit can be completed only at the door, and this is done by moving the lever to the right or left, operations which raise or lower the door.

The operation of this system is as follows: In case of an emergency such as a collision, the officer on the bridge can immediately close every water-tight door throughout the vessel, a small signal lamp at the bridge, or other selected station, lighting up during the movement of the door and going out as soon as the door is closed. If any of the crew should be shut in a water-tight compartment, or should it be necessary to pass from one compartment to another after the doors have been closed from the central station, all that is necessary is to turn the spring lever at the particular door, when it will open, the lever returning to the central position and closing the door automatically when the person has passed through. Mechanically considered, the door is an excellent piece of work both in design and construction. Judging from its operation as now installed on the "Atlanta," it appears to admirably fulfill the requirements of a perfect water-tight door installation. We understand that Mr. Bowles' system will probably be exhibited at the Paris Exposition, where, by the way, the valuable Pollok prize is to be awarded for the best marine life-saving device submitted. Fuller details regarding the system can be gathered from a paper read by Assistant Naval Constructor Watt at the recent meeting of the Society of Naval Architects and Marine Engineers, and published in the Proceedings.



STONE CRABS THAT RESEMBLE ROCKS.



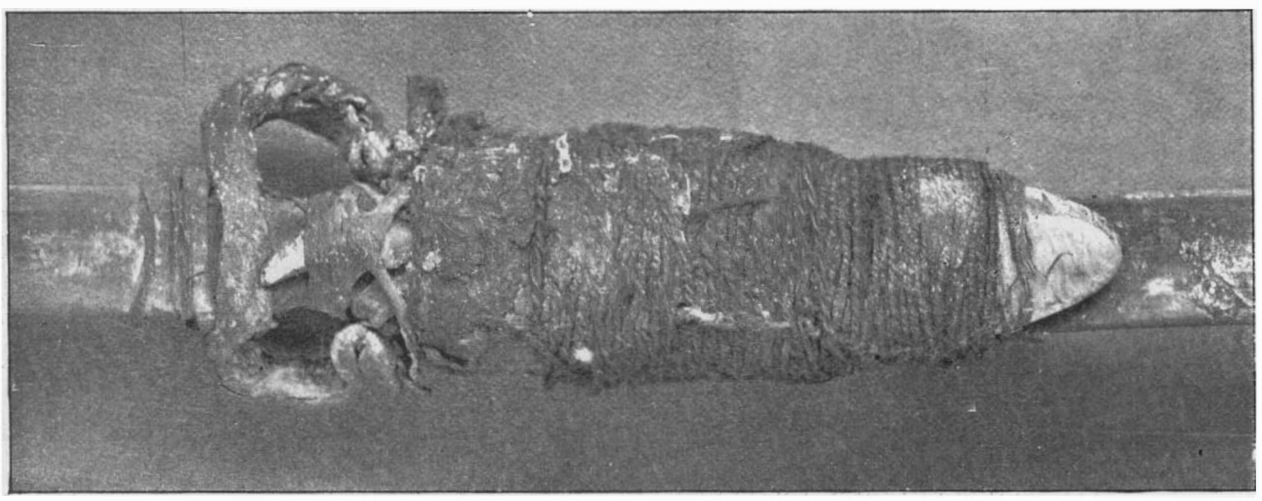
KELP FISH (*Heterostichus rostratus*), SHOWING ITS VERTICAL POSITION IN THE TANK, MIMICKING THE KELP IN SHAPE AND COLOR.

Such is the "Atlanta" as she will appear when leaving the navy yard for her trial trip. The renovation and reconstruction have been so admirably planned and carried out, that except for the fact that she possesses only a partial armored deck, this vessel will now be well up to the standard of modern cruisers of her class.

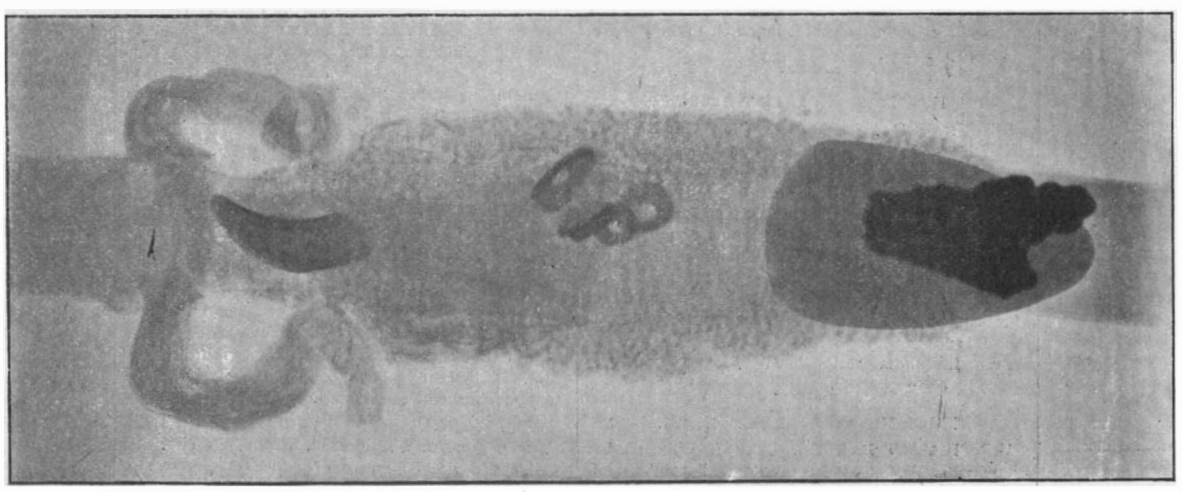
ARCHÆOLOGICAL APPLICATION OF THE ROENTGEN RAYS.

Shortly after the announcement of the discovery of the Roentgen rays, Prof. Stewart Culin, of the Free Museum of Science and Art of the University of Pennsylvania, foresaw the possible future of the new rays in examining the internal construction of valuable museum specimens. After suitable apparatus had been installed in the Pepper Clinical Laboratory by Dr. Charles Lester Leonard, an attempt was made to test the practical application of its value in archæological work. Dr. Leonard made a successful radiograph of a Peruvian mummy, and the photograph disclosed the fact that the closely wrapped bundle contained the skeleton of a child having a string of stones or shell beads about its neck. Another radiograph was obtained of a desiccated human foot with a leather sandal. This gave promise of the utility of such pictures in the examination of such objects. Mr. Cushing expressed the opinion to Prof. Culin that a piece of turquoise was concealed beneath the heavy wrapping of brown yarn that binds the finger loops of every fine prehistoric throwing stick from Mancos Cañon, Col., in the University Museum. Mr. Cushing was of the opinion that the turquoise was the heart of a fetish bird. It occurred to Prof. Culin that the verification of this conjecture might be secured, and photographs of the wrappings with corresponding radiographs were made, with the result as shown in our engravings, which we are enabled to present through the courtesy of Prof. Culin.

It will be seen that four stone beads, presumably of turquoise, are revealed as Mr. Cushing had surmised. The extreme fragility of the wrapping was such as to render an examination by other means impossible without serious injury to a most valuable specimen. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT appears Prof. Culin's article, accompanied by additional side views of the specimen.



Finger Loops with Wrappings and Fetiches of Throwing Stick, from Cliff Dwelling, Mancos Canyon, Colorado.



Radiograph Shows Inclosed Stone Beads Concealed by Wrapping.

AN ARCHÆOLOGICAL USE OF THE ROENTGEN RAYS FOR THE EXAMINATION OF A THROWING STICK.

MIMICRY OF THE KELP FISH.

BY CHARLES FREDERIC HOLDER, PASADENA, CAL.

It is said of certain natives of South Africa that when they go into battle they carry bushes in their hands and move so slowly along that it is almost impossible to distinguish them from the mass of verdure about them. When an American warship is about to begin an engagement she is painted lead color, the object being to make her simulate the color of her immediate environment. Even the men behind exposed guns on the cruisers during the late war were ordered to paint their clothes the prevailing hue, so that the sharpshooters of the enemy would not pick them off.

This is called mimicry; the subjects imitating their surroundings as a protective measure; and that man has obtained the suggestion from nature is evident to any one who has made even a superficial study of the subject, as in every branch of animal life some forms are found which protect themselves from enemies in the manner described, namely, by imitating more or less their surroundings.

This singular mimicry is exhibited in a particularly interesting manner among fishes, and the accompanying illustration shows one

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of the most interesting mimetic fishes common to the Southern Californian islands. It is generally known as the kelp fish, a most appropriate name, as the fish makes its home in the kelp beds which constitute the real protection of the Pacific coast.

The writer first observed the fish alive when drifting over the kelp beds in eight or ten feet of water. Then it was occasionally seen poised among the dark green weeds, presenting a beautiful appearance in a garb of vivid olive green, its long slender form undulating, as it were, in the current, a picture of grace. The largest specimen observed at Santa Catalina was a foot in length. The body was slender, the head pointed, eyes prominent. Along the back was a continuous frill, formed by a long dorsal, while opposite, the anal fin was an equally effective ornament. The fishes varied much in color. One observed was amber; others were orange or a vivid green, while others again were olive hued and some dark green above and below yellow and green combined.

Nearly all the specimens observed were lying in the kelp beds or in some large-leaved algæ, and with difficulty could be seen by those in the boat who were not familiar with the fish. The fish was a marvelous mimic of its surroundings, and affected the kelp leaves that bore a close resemblance to its body and consequently afforded it protection. Its shape corresponded to that of the smaller leaves of macrocystis, the dorsal and anal fins giving it the ruffled appearance that is a feature of these leaves. All these fishes were observed through the windows of the glass-bottomed boat—a craft peculiar to Avalon Bay; a boat in the bottom of which four or six plates of heavy glass have been placed, a well rising into which the voyager looks, observing the bottom clearly, and all the objects slightly magnified.

The peculiar positions of the fish attracted attention, and when the tanks of the Zoological Station were available, a number of specimens were placed in them for observation. The feature that most interested the average observer was that, apparently, the fish could turn its head; this impression being gained from the fact that the fish swam in a laterally undulatory motion that was the personification of grace, and invariably poised in some odd or strange position. When placed in a tank by itself, a fish would at once manifest its uneasiness, swimming about, rubbing its tender lips against the glass and whipping its tail against it, with a result that it was soon disabled and died. The fishes so placed seemed to appreciate the fact that they were conspicuous objects and so liable to attack. Some individuals were so alarmed that they repeatedly leaped from the tank, and others in various ways displayed their fright.

The writer prepared a tank, or furnished it, to imitate as nearly as possible the natural surroundings of the fish. The bottom was covered with a rich green ulva, while along the surface was suspended a branch of macrocystis, so that the leaves depended into the water, as seen in the illustration. Three or four fishes were now released into this tank, individuals which before had displayed great uneasiness. They at once swam to the dependent kelp leaves that were remarkable imitations of themselves, and one pushed into a coil in a leaf and rested, its head up within a few inches of the surface. Another in a few moments hung head downward, while a third poised with head upward, as shown in the photograph, becoming so remarkable a mimic of the hanging leaves in shape and color that to all intents and purposes it had disappeared. The fishes immediately recognized their security and made no effort to escape from this tank.

So perfect was this disguise that few strangers could see the fishes that were not eighteen inches distant until they had been pointed out, and then they almost doubted the evidence of their eyes, the tint of the kelp being perfectly produced in the color scheme of the fish. When not disturbed they invariably made use of this instinctive mimicry as a protective measure, and that it is effective in the sea where they make their home there can be little doubt, as few predatory fishes could distinguish the mimic as it floated among the leaves, its body assuming various positions as it adapted itself to the current and the weed that constituted its protection.

The kelp beds which surround the islands of Southern California have an interesting fauna of their own of which this kelp fish can be considered the most remarkable member. Another is a crab that is painted so exactly the color of the kelp—a rich olive green—that it is never noticed unless it happens that the observer is looking at it and sees the olive-hued legs lifted slowly one by one. Usually the crab clings to the under side of the kelp in the deep tangles, but it is sometimes driven up by enemies and can be seen climbing over the surface of the leaves. One of these kelp crabs when taken from its native element and placed in a tank without kelp immediately displayed uneasiness and attempted to escape, evidently aware that it was a bright and conspicuous object, but when the kelp was introduced it crawled upon it and like the dissolving view seemed to melt away and disappear.

The crabs alone afford many remarkable examples of mimicry. One shown in the accompanying photograph is so perfect in its imitation of a rough stone that it is almost impossible to detect it. When alarmed it draws in its legs and becomes, to all intents and purposes, an inanimate rock. The writer kept several deep sea spider crabs in a tank for several months. They were dredged in water about 800 feet deep, where, presumably, it was dark, and such an animal would hardly be seen. When one was taken from the net, it was apparently lifeless, and of a peculiar brown color, perfectly clean, not a suspicion of weed being attached to its shell. When placed in a tank in a bright light it rarely moved, and resembled a rock; even when moving, its legs turned so slowly that it could scarcely be termed locomotion. Yet this type of sluggish life had sufficient intelligence to recognize that it was now near the sunlight that it had never seen, and that, perforce, it was a conspicuous object and might, possibly, become the victim of some predatory fish, so it began to add seaweed to its back, after the manner of many of its shoal-water allies. But this was done in a very singular way; the weed was plucked, then passed to the mouth, and, finally, attached, not to the back, but to the point of the shell above the mouth, so that they fell over the latter like a fantastic umbrella or gorgeous plume, really making the crab more conspicuous, except when it threw itself back, as it did when it was startled, when the plume of seaweed would point nearly upward, and the crab would become a rock, with a tuft of weed growing on it, well calculated to deceive the most observing enemy.

The Current Supplement.

The current SUPPLEMENT, No. 1252, has many most interesting articles. "The Destruction of the Hypostyle Hall in Karnak" describes a recent accident which has robbed the great temple of considerable of its attractiveness. "Bacteria and Their Uses" is an article by A. Dinsmore. "The Electrical Plants of the Battleships 'Kearsarge' and 'Kentucky'" is by Naval Constructor J. J. Woodward, United States Navy. "Long-Span Bridges" is an address by Prof. W. H. Burr, and is elaborately illustrated. "Progress of Mechanic Arts in the Last Three-Quarters of a Century" is an important address by Dr. Coleman Sellers. "Effect of Weather on Every-Day Life" is an interesting article.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

LISTED-CORN CULTIVATOR.—JOSEPH M. TAGUE, Cambridge, Neb. The main frame of this cultivator is swiveled at its forward end on sled runners and has a wheel-supported rear end. A disk-carrying frame is pivotally mounted on the main frame. The driver's weight can be more or less thrown on the disk-carrying frame. The cultivator is capable of efficient adjustment and of being easily guided in the furrow by reason of the swiveling of the runners to the main frame. By pivotally mounting the disk-carrying frame on the main frame, the disks are enabled readily to pass over any obstacle in their way.

Bicycle-Appliances.

SAIL-ATTACHMENT FOR BICYCLES.—RUDOLPH SORENSEN, Ord, Neb. The sail-attachment comprises a mast carried by a support by which it is held in a plane below the rear axle. A brace for the upper end of the mast is arranged for attachment to the bicycle-frame. A sail is carried by the mast, and a sheet engages the boom of the sail. By means of a reel on the bicycle-frame, the sheet can be wound up and unwound. The sail can be easily applied or removed, and since it is supported below the axle, the bicycle is balanced and runs steadily.

Mechanical Devices.

WINDMILL.—CLEOMER PREJEAN, Milton, La. The invention is an improvement in that class of windmills in which a series of blades or vanes are pivoted to a wheel arranged vertically and mounted upon a horizontal axis having an extension provided with an expansible tail or guide, the whole being mounted upon a stationary base, so as to revolve horizontally. The improvement relates specifically to the construction of the wheel proper, means for adjusting the pivoted blades or vanes to throw them into or out of the wind, and the construction of the tail, whereby it is adapted to be expanded or closed corresponding with the position of the blades or vanes forming part of the wheel.

WEIGHING AND MEASURING MACHINE.—SAMUEL P. MACKEY, Ridgefield, Wash. The purpose of this invention is the provision of an apparatus for measuring and delivering a certain quantity of liquid, to which end the apparatus consists of a rocking tank having an outlet-valve actuated by the rocking movement of the tank and operating with certain mechanism for restoring the tank to upright position after the rocking and for controlling the supply of liquid to the tank. The apparatus may be actuated by a coin-controlled mechanism.

MACHINE FOR STEMMING AND CLEANING RAISINS.—CARY S. COX, Fresno, Cal. In this machine for stemming and cleaning raisins, a fixed and a rotary screen are provided. A feed device is arranged to deliver the fruit between the two screens, and the fruit is subjected to currents of air. A cleaning mechanism is provided for the rotary screen, which is adapted to remove stems or other material that may lodge in the meshes of the rotary screen. The raisins are stemmed and cleaned without injury to the latter, and the dirt and dust, it will be observed, are removed and conducted from the machine through a medium independent of that employed for conducting the cleaned fruit.

PIPE-WRENCH.—ROBERT FJELLMAN, Wilmot, S. D. The device can be used both as a wrench and pipe-cutter. In its construction is included a handle, one end of which is toothed on one side to form a pipe-engaging surface and the opposite side formed with a transversely-extending concavity. A longitudinally-slotted yoke passes about the bar near the jaw, and a removable pin passes through the slots in the yoke and through the bar. A jaw projects from one end of the yoke parallel with the other jaw. A set-screw passes through the other end of the yoke and engages the bar or handle, whereby the separation of the jaws may be regulated. A cutter is adapted to be secured to the jaw upon the yoke.

WASHING-MACHINE.—JOHN H. GEERS, St. Louis, Mo. The machine comprises a body having a vertical rear wall provided with guides on its face. Plungers work in the guides and have their upper ends projecting above the rear wall of the body. Pounders are rigidly secured to the lower ends of the plungers. A lever is pivoted at its center to the outer face of the rear wall of the body. Pitmen have their lower ends pivoted to the ends of the lever and their upper ends to the upper ends of the plungers. By oscillating the lever an alternate reciprocating movement is imparted to the plungers and their pounders.

Railway-Contrivances.

LUBRICATOR AND WIPER FOR LOCOMOTIVE AXLES.—JAMES S. PATTEN, Baltimore, Md. The usual means for conveying oil to the axle-journals is cotton-waste packed in the boxes, or "cellars" as they are called. From time to time this packing must be renewed, which can be effected by removing and replacing the cellar. The present invention utilizes the cellar, but avoids the necessity of its frequent removal. The lubricant is taken up, not by cotton waste, but by means of rollers, which, together with a yielding wiper whereby the oil is prevented from "creeping" along the journal, are contained in the "cellar" or box.

Miscellaneous Inventions.

VENTILATED BARREL.—JOHN S. WRIGHT, JR., Churchland, Va. This improved ventilated barrel is composed of an outer set of straight, parallel-sided staves whose ends are in contact, and an inner set of wedge-shaped staves, arranged with their narrow and wider ends alternating, the wider ones overlapping the narrow outer staves, the width of the respective inner and outer staves at the middle being practically the same, and the staves of one set being placed flat against the other so that their middle portions coincide, and bent to form a bilge or convexity and produce the elongated coincident openings.

HAT-CASE OR VALISE.—NELLIE F. HURDEL, Manhattan, New York city. The hat-case consists of two similar parts hinged together, having secured in one side a longitudinal shaft, adapted to support a series of vertical, adjustable, hat-supporting arms arranged one above the other and provided with clamps. The shaft is hinged to one end of the case approximately near the hinge and provided on the other end with a lug to engage a recess in a spring on the opposite end of the case. The hat-case may be used in traveling-cases, shipping-boxes, and show-cases, or in closets and wardrobes.

SASH-FASTENER.—ALEXANDER FORIN, Nelson, British Columbia, Canada. It is the object of this invention to provide a fastener which will operate to secure the sashes in closed position and also hold them at different elevations. The fastener comprises a bearing in the window-jamb at a point above the lower sash when it is closed. A pawl is rotatably mounted in the bearing and normally engages the lower sash when the latter is raised, and is of such length that when turned down or reversed into vertical position its free point will abut against the mid-rail of the lower sash, so as to fasten the sash in closed position.

STOVE OR OVEN-DOOR LIFTER.—MATHIAS WEIXLER, Louisville, Ky. It is the object of this invention to provide the doors of stove-ovens and furnaces with an attachment for holding them closed and for assisting in closing them. The main feature of the invention is found in a coiled torsion spring so arranged as to perform its natural function as well as to serve as a handle for opening the door. The spring so operates as to prevent slamming either in opening or closing.

SEWING-MACHINE SHUTTLE.—PERCY H. HEWITT, EDWIN A. COCKLE, and CHARLES MATTHEWS, Oakley House, Spring Grove, Isleworth, London, W., England. The sewing-machine shuttle is open at the heel end, into which a removable cap fits. The cap and shuttle are provided one with a pin and the other with a locking-slot, the inner end of the slot trending backward or toward the edge of the member containing it, so that the cap must be moved inward to release it. The trend of the spring is transmitted to the cap through the spool. By this construction the disadvantages of complexity and expense are avoided.

WINDOW-BRACKET FOR CLOTHES-LINES.—JOHN G. VON HOFE, Manhattan, New York city. To provide a device by means of which clothes can be easily hung upon a line without the necessity of the person's leaning out of the window, this inventor has devised a clothes-line bracket pivoted at one side of the window and provided with means for securing the line to its outer end. A bar is pivoted to the outer end of the bar and is adapted to engage the inner side of the window-sash. A detachable bar connects and holds the swinging bar and the bracket from each other.

PROCESS OF UNHAIRING SKINS AND TRANSFERRING FUR, FEATHERS, HAIR, ETC., TO ARTIFICIAL BACKINGS.—JOSEPH A. MALAISÉ, Avenue de la République 45, Paris, France. The hitherto-employed methods for unhairing skins are objectionable, because the hair is often incompletely removed, while the depilatory medium being immediately in contact with the grain side (the finest part of the leather), injures the leather and causes it to lose its fineness. To overcome these objections, the inventor first applies to the hair side a coating of a substance to hold the hairs, then to the flesh side a substance serving to penetrate the skin to facilitate removal of the hairs. The hairs are removed and the roots coated with rubber. A backing is embedded in rubber, and the backing is connected with the rubber-coated face of the substance holding the hairs. The substance in which the hairs are embedded is then removed.

WINDOW-SASH.—GEORGE T. SOPER, Far Rockaway, Queens, New York city. The sash is especially adapted for coach and carriage use and is so constructed that the covering will be preserved to a maximum extent and prevented from becoming loosened from the sash. The sash is furthermore so constructed that it will be prevented from rattling, so that even should it shake in the sashways, no noise will be produced.

WIRE BROILING-PAN.—THOMAS F. COONEY, Verplanck, N. Y. The invention provides a skeleton, pan-like dish provided with a handle and constructed of wires which are bent so as to form the outline of the device and secured together by having certain portions bent about other portions. A broiler is thus produced which may be set into the stove, being supported upon the stove-top and which may be covered to prevent the spattering of fat.

Designs.

CLOTHES-SPRING.—JAMES N. CARTER, McKinney, Texas. This clothes-spring is made of a coiled wire having its terminals in the form of side arms with loop-like handles. The device is noteworthy for its great superiority over the old-fashioned clothes-pin and for the simplicity and cheapness of its construction.

WALL-PAPER.—HARRY WEARNE, Rixheim, Germany. Four designs have been issued to this inventor for wall-papers, in which flowers and vines are combined in various forms to produce a pleasing and artistic effect.

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References to former articles or answers should give date of paper and page or number of question.

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(7775) C. H. B. asks: What is meant by the repeater of a telephone, and why is it so difficult to construct? A. A telephone, repeater is an instrument which will take up a message when it has gone as far as it can be heard on the line, and give it energy so that it can go as far again and still be heard as well as it was before. In other words, it is to double the distance to which a message can be sent. There is a "repeater" which is used to connect a metallic circuit to a grounded circuit. This is not difficult of construction and is not probably what you refer to in your question.

(7776) H. I. asks: What are the proportions of corrosive sublimate, sal ammoniac and water for the purpose of depositing a very thin coat of mercury on articles which do not plate readily? A. The proportions of corrosive sublimate and sal ammoniac for the purpose of depositing a thin film of mercury upon articles to be plated is not a matter of any great importance. Water will not dissolve much corrosive sublimate. You may let it take all it can. If the solution is strong, the coating of mercury will be deposited sooner than if it is weak.

(7777) H. B. writes: I am making an automatic circuit breaker for my battery plant, and I would like to ask a few questions in regard to the solenoid and the solenoidal coil. I want the solenoid to trip at 2 amperes; how is the coil constructed? What size wire shall I wind on the coil to be connected in series with the line? What shall I make the solenoid out of? A. Any calculations for an automatic circuit breaker would have very little value. The proper mode of procedure is to make the circuit breaker and then adjust the tension of the spring till the circuit is opened when the current has the strength you wish to set it for.

(7778) The A. & J. Co. writes: We believe there is in use a paper upon which brass will make a mark, something like a pencil mark. If you can tell us what this paper is, where it can be obtained, or who makes it, we will be greatly obliged. A. Paper prepared so that a brass pointer leaves a black mark on it. Dissolve ¼ ounce pure sodium sulphide and ½ ounce sodium hyposulphite in 1 quart rain water; filter the solution, and with it uniformly moisten the surface of the paper; then dry the latter under pressure between clean blotting paper. We do not know where it can be purchased.

(7779) B. T. S. asks: 1. What are the temperatures of air and of the various gases when liquefied? A. The boiling point of liquid air at the ordinary pressure is 312·6 degrees below zero Fah. Under the same condition oxygen boils at −297 Fah., and nitrogen at −317 Fah. The data for various gases can be found in Sloane's "Liquid Air," price $2.50 by mail. 2. What is the distance in miles from the highest to the lowest points from the plane of the sun's equator reached by each of the planets? A. We have never seen these distances given in any astronomy. You can compute them from the mean distance of the planet and the angle of inclination of the orbit to the plane of the ecliptic. The formula is, perpendicular = base × tangent angle at base. The perpendicular is the distance in miles above the plane of the sun's equator, and the angle is the inclination of the planet's orbit. The mean distances and the angles are given in all astronomies. 3. Where can I purchase a reliable radiometer? A. A radiometer can be purchased from any dealer in physical apparatus. They are not expensive instruments.

TO INVENTORS.

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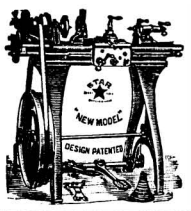

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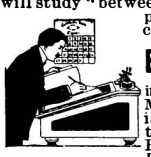

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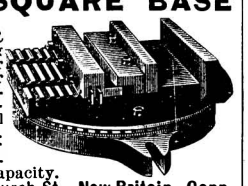

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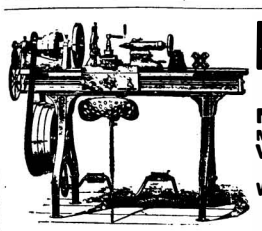

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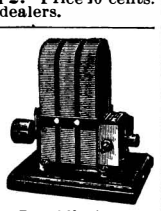

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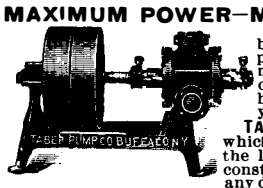

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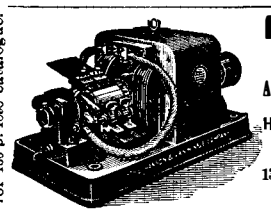

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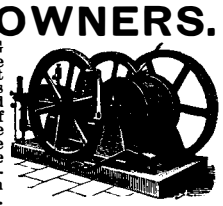

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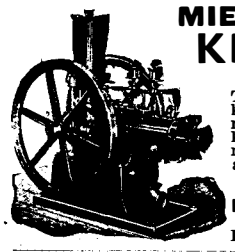

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Trap hook, W. Gabrielson	639,553
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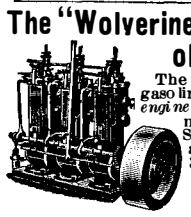

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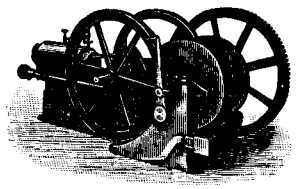

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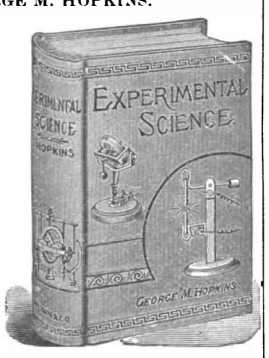

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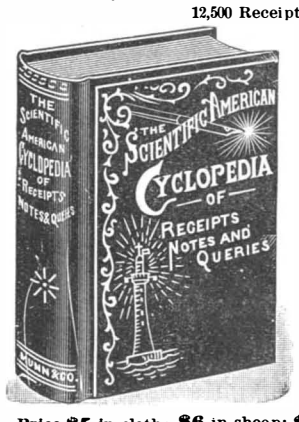

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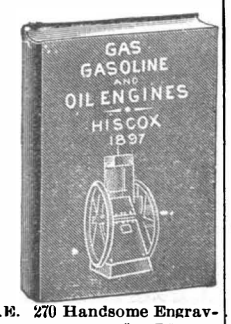

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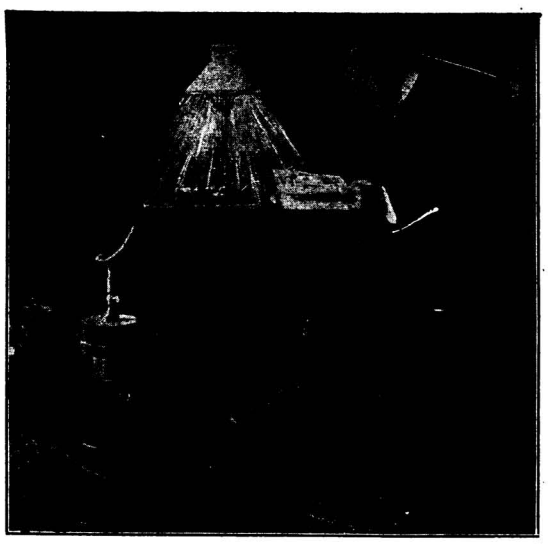

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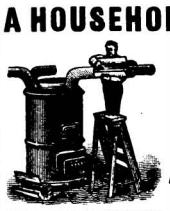

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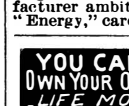

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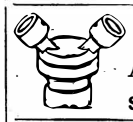

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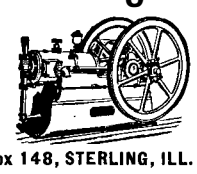

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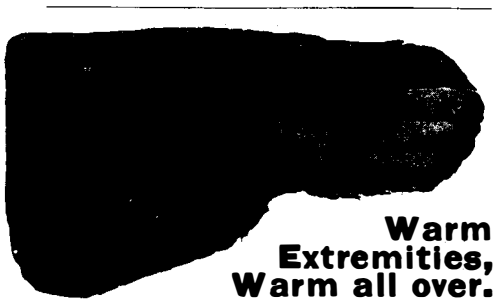

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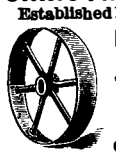

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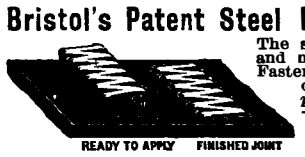

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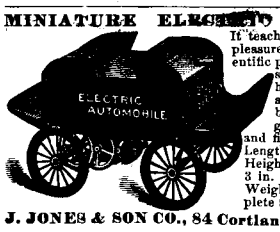

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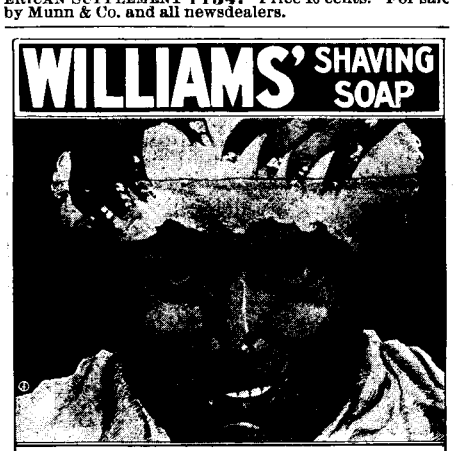

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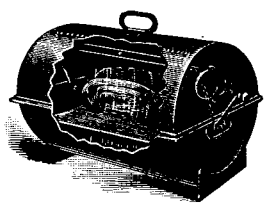

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